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THE PHILIPPINE AGRICULTURIST

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A CHALLENGE FOR COLLEGE MEN AND WOMEN [1]

As a person who believes most firmly that education is essential to agricultural progress, I am very happy to talk with the students and faculty members of the College of Agriculture of the Philippines. I know you are proud to be associated with an institution that ranks highest among the agricultural colleges in Southeast Asia.

You can take added pride in your connection with an outstanding agricultural college when you recall the predominant importance of agriculture to the economic and social welfare of the Philippine Republic. Whatever the claims to be made for other segments of the Philippine economy, there can be no question that the nation's welfare will rise and fall with the welfare of agriculture.

Let us look a minute at the predominance of agriculture in the Philippines. In 1950, agricultural production amounted to more than four billion pesos, or 80 per cent of all national production. Among exports from the Philippines, agricultural products accounted for 87 per cent of the total value and brought precious foreign exchange to the whole nation. Finally, we should remember that the farm men and women behind this agricultural production make up 70 per cent of the total population of the nation. There can be no question that the soil and the people who till it are the foundation of this country.

It is generally admitted that much can and should be done to strengthen that foundation. The report of the Bell Mission from the United States in 1950 concurred with Filipino leaders in calling attention to the possibilities for greatly increased agricultural production and improved social conditions for rural people. Here is a great opportunity for the people of the Philippines to develop a stronger agriculture, and no group has a bigger challenge from this opportunity than the students and faculty of the College of Agriculture.

I know that the men and women of Los Baños can and will meet this challenge. It should inspire and at the same time raise sober thoughts for everyone in agricultural education.

In my own country, there was a time when the guiding philosophy of education followed the classical approach. Even in agricultural education, there was heavy concentration upon Latin and Greek names for plants and animals, terms that scientists used to address one another and confuse ordinary people. Little attention was given to obtaining and disseminating practical knowledge that farmers could use in operating their farms.

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[1] Miscellaneous Contribution No. 25. Excerpts from the talk by Mr. Edward J. Bell, Director of the Agriculture Division, ECA Mission, at a convocation of the U. P. College of Agriculture and Central Experiment Station on January 23, 1952.

THE PHILIPPINE AGRICULTURIST, VOL. 36, NO. 1, JUNE, 1952.

Then, during the presidency of Abraham Lincoln, education in America was given a new meaning and a new point of view by the establishment of a system of Land Grant Colleges whose stated purpose was to prepare students from the industrial classes for the various pursuits and vocations of life. The Land Grant Colleges are now found in every state of the Union training men and women to meet the problems of agriculture and industry when and where they occur on the farms and in the factories.

When your college was established on June 14, 1909, it was patterned after the educational philosophy of the Land Grant Colleges. The wisdom and beneficial results of that philosophy are reflected in the good works of the alumni of Los Baños whose contributions through the years have been a bright spot in Philippine agriculture and forestry.

The ravages of World War II disrupted the physical resources of the institutions here, and much of the equipment and buildings were destroyed. But your brilliant scientists remain and have continued to perform highly regarded research and teaching in spite of damaged buildings and meager equipment.

One of the first projects recommended by the Philippine Government under the joint program of the Philippine Council for U. S. Aid and the Economic Cooperation Administration was to rehabilitate the College of Agriculture. This project is now in operation and calls for an expenditure of 931 thousand dollars and one million pesos for equipment and supplies. These funds are being spent for such items as laboratory equipment, scientific and professional instruments, farm tools, journals and books for the college library, and repairs to roads. A similar program is also being developed for the College of Forestry. When completed, these projects will stand as a monument of achievement through the partnership of two great nations—the Republic of the Philippines and the United States of America.

This partnership is not a one-sided agreement. It is a true partnership in which Filipinos and Americans are working together to help keep your country strong, free, and independent in the spirit of the long friendship and mutual help between the two countries. On our side, Americans are furnishing some technical advice and dollars. On your side, the Filipinos are furnishing natural resources, labor, leadership, and pesos. I honestly believe the really important half of the partnership rests with your country because any permanent improvement in a country must be brought about by the people who live there. The success and scope of this partnership program cannot be measured in dollars and pesos. Instead, it will be measured by the inspiration, know-how, and tools it gives Filipinos to develop your own rich resources.

The success of this partnership between two great nations should be an example for various groups in agriculture to work closer together. Their partnerships should embrace the College of Agricul-

ture, the Department of Agriculture and Natural Resources, and, most important of all, the men and women who actually till the soil and maintain the households in rural communities.

. . . . . .

In the United States, it took many years to recognize that even in the Land Grant Colleges, many valuable discoveries to improve agriculture never went beyond the laboratory, the experiment station, and the scientific report. Farmers continued to till the soil in the old way and scientists made their studies and published their reports, and there was little or no contact between them. Then, in 1914, the U. S. Congress enacted a law for an Agricultural Extension Service that today reaches practically every farm home. The U. S. Extension Service has brought the results of the laboratory and experiment station to the individual farmer with startling results. Even more important, it helps the farmer to help himself. The American farmer has become the most productive in the world because, with the help of the Extension Service, he has learned to work with his neighbors in meeting common problems. He has also learned to tell the scientists what problems are most important to him. He has learned to work in partnership with the scientist and engineer and to apply their technical information to the soil and climate of his particular farm.

I am confident the same success can be attained in the Philippines. But first there is need to coordinate and strengthen the various extension services of the Department of Agriculture and Natural Resources into one unified agency. I understand that legislation to organize a unified Extension Service with adequate financial support will be presented to the Congress this session. Establishment of a centralized Extension Service, with well-trained men and women who are really interested in the welfare of farm people, can bring about better production and homemaking practices in every barrio.

But no organization can be effective without trained and enthusiastic workers. The training of Extension specialists and supervisors falls heavily upon the U.P. College of Agriculture. Information about new discoveries in production and homemaking techniques not only must be brought to farm people but it must be presented to them in a way that they will understand and with a persuasion that will cause them to apply it.

I should like to suggest another essential qualification for an Agricultural Extension worker. He should have a sympathetic appreciation and a sincere admiration for farm people and their problems. He cannot acquire this appreciation and admiration anywhere except in the barrios where farmers live and work. I might add that everyone in government and education striving to improve agriculture must work closer with the farmer and homemaker if agricultural improvement programs are to achieve maximum success.

Extension workers must be prepared to help all members of the farm family. It is not enough to demonstrate methods for increased farm production. Farm women must be given advice and encouragement on ways to lighten their burdens of work in the home and in the field. Farm boys and girls need to develop leadership and ability to work together so as to prepare themselves to become better farmers and homemakers.

For agriculture is more than test tubes and petri dishes. It is more than high-yielding varieties of palay and maize. It is more than sleek carabaos, fat hogs, and bigger cattle. Agriculture is the man in the paddy with the water buffalo. It is the woman on the river bank washing the family clothes. It is the little boy riding his carabao and dreaming of what great things he will do when he grows up to be a man. It is the little girl helping her mother prepare the evening meal.

So I ask—as educated men and women, what is our real attitude toward the men and women and the boys and girls in the barrios? Are we sincerely interested in them as human beings and in their problems? Do we fully intend to help them improve their way of life, to own the land they farm, to get a fair share of the wealth they create, to feel hope and inspiration for a better future?

Or are we interested only in our personal careers? Do we fully realize our responsibility to take the knowledge that we now have and the knowledge that we shall obtain from future research and to put that knowledge to work for the benefit of the ordinary farm family?

The answers to these questions lie with you, and your ability to answer them correctly will determine the future of your country.

A TRIAL PLANTING OF SOME DRUG AND CONDIMENT PLANTS [1]

JOSÉ R. DEANON, JR.

WITH NINE TEXT FIGURES

Of the ten species of medicinal and condiment plants used in the trial planting (belladonna, dill, caraway, coriander, digitalis, American wormseed, stramonium, fennel, henbane, and horehound), only dill, American wormseed, belladonna, and stramonium reached maturity. The heavy rainfall and high humidity in Los Baños proved inimical to the growth of the plants. Serious fungus diseases killed most of the plants before they reached maturity.

The Philippines imports annually a large amount of botanical drugs and condiments which are afterwards sold at prohibitive prices in the local market. Very little attention has been given to these drug and condiment crops because they are used in limited quantities only. A shortage, however, results in high prices.

Many of these medicinal and condiment plants are commercially grown in countries where the soil and climatic conditions are similar to those found in some parts of the Philippines. According to Lowman and Birdseye,[2] many of these plants are adapted to a wide variety of soil and climatic conditions. Recently there has been an increasing interest in growing these special crops locally because their cultivation in the Philippines will not only reduce our dependence on imported products and provide Filipino farmers with an additional source of income, but it is a very interesting hobby as well.

The present study was conducted from May, 1951, to September, 1952, in the nursery and experimental fields of the Division of Perennial Crops, Department of Agronomy, Central Experiment Station of the College of Agriculture, Los Baños, Laguna, to test methods of propagation, culture, and general handling of ten medicinal and condiment plants and to compare their yields of marketable parts or products.

MATERIALS AND METHODS

The seeds of the ten medicinal and condiment plants used in this trial planting were obtained by the College of Agriculture from the United States Department of Agriculture, Washington, D.C., through Mr. Merrill W. Abbey of the American Embassy, Manila. The plants

[1] Central Experiment Station Contribution No. 1658. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of Associate Professor Pedro A. David.

[2] LOWMAN, M. S., AND MIRIAM BIRDSEYE. 1946. Savory herbs: culture and use. U. S. Dept. Agric. Farmers' Bull. 1977: 1–35.

included (1) belladonna (*Atropa belladonna* Linn.), (2) dill (*Anethum graveolens* Linn.), (3) caraway (*Carum carvi* Linn.), (4) coriander (*Coriandrum sativum* Linn.), (5) digitalis (*Digitalis purpurea* Linn.), (6) American wormseed (*Chenopodium ambrosioides* Linn.), (7) stramonium (*Datura stramonium* Linn.), (8) fennel (*Foeniculum vulgare* Linn.), (9) henbane (*Hyoscyamus niger* Linn.), and (10) horehound (*Marrubium vulgare* Linn.).

Another shipment of seeds of these plants was received from the United States Department of Agriculture through Associate Biochemist M.S. Lowman of Beltsville, Maryland, in March 1952. Judged by their external appearance, the seeds were apparently fresh.

All the plants were propagated by seed. The seeds were all sown on May 25, 1951, in ten 7-inch pots, 21 centimeters in diameter and filled with pulverized and sterilized sandy soil. As soon as the plants had germinated, they were counted to determine their percentage of germination.

When the seedlings were about 5 to 10 centimeters tall, they were transplanted in large drums cut in half and filled with well-pulverized and sterilized soil. The time of transplanting varied for different plants. With the exception of belladonna, which was not transplanted, the distance of planting was 10 x 10 inches for dill, 16 x 16 for caraway, 15 x 15 for coriander, 12 x 12 for digitalis, 10 x 10 for American wormseed, 10 x 12 for stramonium, 8 x 12 for fennel, 15 x 20 for henbane, and 6 x 6 for horehound.

Weeding was done occasionally to maintain clean cultures. Observations on the time of emergence, height, fruiting habit, percentage of commercial products, and resistance to pests and diseases were made.

When the plants matured, they were harvested and the weights of their roots, stem, leaves, flowers, and fruits were determined separately. These parts were thoroughly dried and stored in airtight containers.

RESULTS AND DISCUSSION

Dill, *Anethum graveolens* Linn., (fig. 1) is an annual or biennial plant often grown in gardens for its herb and seeds which are used for flavoring foods and pickles. The oil extracted from its dried seeds is used as a stimulant and as a carminative. The plant is aromatic. Although a native of southern Europe, it grows well in fertile loam soil in a much cooler climate. Lowman and Birdseye [3] reported that it grows wild in various parts of Africa and Asia. Its stem is very smooth; its leaves are dark green; its flowers are small and yellowish; and its seeds are small and flat. Its little petals fall off early. In the United States it grows to a height of three to four feet.

[3] *Ibid.*

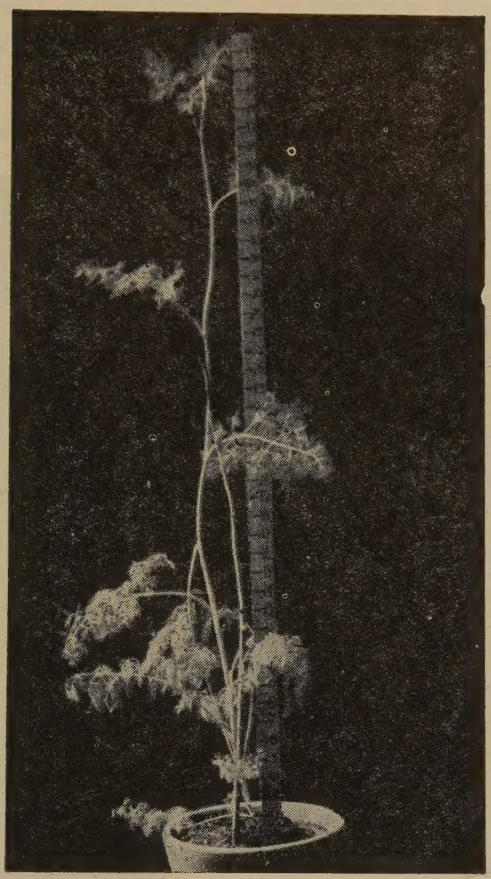

Fig. 1.—Dill, *Anethum graveolens* Linn.
(*Photographed by Olive's Studio*)

In this study the annual variety was used. Germination, which began five days after sowing, was complete on the seventh day. Ten per cent of the seeds germinated. Transplanting was done on June 27, 1951 (table 1).

During June and July the growth of the plants was luxuriant. On August 10, 1951, however, a heavy rain occurred which badly affected the plants; all but one died soon after. The lone surviving plant, which was saved for study under controlled conditions, grew to a height of 109.2 centimeters (fig. 1 and table 1). It flowered when it was 164 days old.

On January 8, 1951, the leaves were attacked by fungus diseases, *Botrytis* sp. and *Fusarium* sp.[4]

[4] Determination of diseases by Dr. F. T. Orillo of the Department of Plant Pathology.

The seeds were harvested when the plant was approximately six and a half months old (195 days). Harvesting was done three times because the seeds did not mature at the same time. It was done in the morning to avoid shattering of the seeds. After all the seeds had been harvested, the whole plant was pulled out and the roots

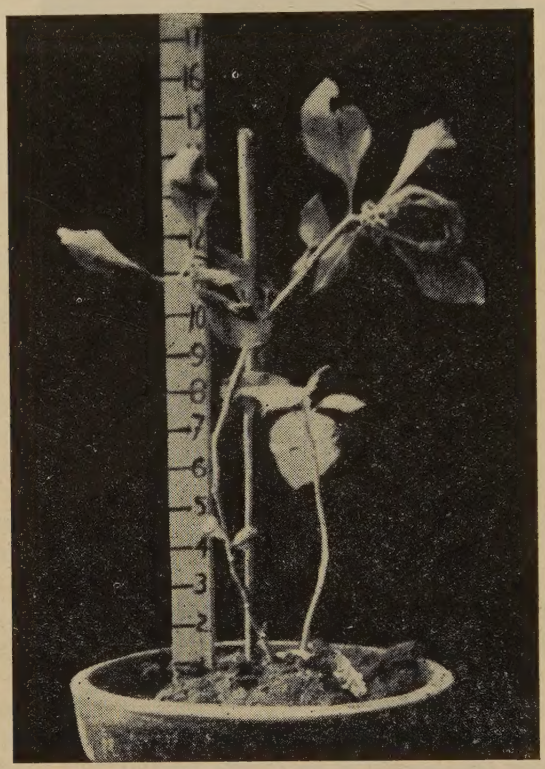

Fig. 2.—Belladonna, *Atropa belladonna* Linn.
(*Photographed by Olive's Studio*)

were washed. The leaves, the stem, and the roots were separated and dried in the shade to preserve their green color. To facilitate their drying, the roots were sliced before they were dried. The dry weight of the roots was 0.5 gram; that of the stem, 2.6 grams; that of the leaves, 2.3 grams; and that of the seeds, 0.0785 gram.

The yield of seeds reported in the United States is 500 to 700 pounds an acre, or 91.33 to 128.03 kilograms a hectare.

Belladonna, *Atropa belladonna* Linn., (fig. 2) is an herb with important medicinal properties because of the alkaloids found in all its parts. The dried plant and the roots are used in the preparation of a number of important medicines which are narcotic, antispasmodic, anodyne, mydriatic and are respiratory and cardiac sti-

mulants. Sievers [5] stated that it is a perennial plant which thrives best in deep and moist but well-drained loam. It is usually propagated by seed, although divisions of the fleshy root stocks can be used for planting.

In this study, the seeds germinated ten days after planting (table 1). Germination was complete on the thirteenth day. Only 5 per cent of the seeds germinated.

The plant, which is erect and branching, has pointed ovate leaves. The flower is blue-purple or greenish purple, single or in pairs on lateral peduncles.

Fig. 3.—Caraway, *Carum carvi* Linn. (*Photographed by Photographic Division*)

The plant in this experiment attained the height of 45.7 centimeters (table 1). Leaf spot, *Cercospora* sp., was found attacking the leaves. All the diseased leaves were removed. The plant began to flower 105 days after germination, but it failed to fruit. After the appearance of the flowers, a sucker appeared at the base of the plant. When the sucker was 51 days old it was harvested and dried in the shade like the dill. The dry weight of one sucker was 0.3

[5] SIEVERS, A. F. 1948. Production of drug and condiment plants. U. S. Dept. Agric. Farmers' Bull. 1999: 1–99.

gram for the leaves, 0.4 gram for the stem, and 0.5 gram for the roots. One month later, when it was 136 days old, the plant died.

The yield of dried herb reported in favorable localities in the United States is more than 1,000 pounds to an acre, or 182.50 kilograms to a hectare. The yield of roots is 150 to 300 pounds to an acre, or 2.54 to 5.48 kilograms to a hectare.

Caraway, *Carum carvi* Linn., (fig. 3) is a native of Europe. It is usually a hardy biennial that withstands a rather severe continental climate and matures and seeds early in the second season. Its aromatic dried fruits or seeds are used as a stimulant and as a carminative. Sievers found that it thrives best in the cool climate of temperate regions.

The seeds germinated on June 2, 1951, eleven days after sowing. Germination was complete after 14 days. Only 15 per cent of the seeds germinated (table 1). The seedlings were transplanted on June 27, 1951. They were attacked by a fungus disease, *Macrosporium* sp., and were thinned to remove all the diseased ones.

Fig. 4.—Coriander, *Coriandrum sativum* Linn.
(*Photographed by Photographic Division*)

The plants grew very slowly to a height of 9 centimeters (table 1). All of them died after the heavy rain on August 10, 1951.

Coriander, *Coriandrum sativum* Linn., (fig. 4) is an annual herb which has long been cultivated in many parts of the world. The

dried fruits, known commercially as seeds, are used for flavoring candies, sauces, soup, beverages, and tobacco products. The volatile oil distilled from the seed is used as a stimulant and as a carminative. Sievers reported that the plant is indigenous to southern Europe, Asia Minor, and the southern part of the Union Soviet Socialist Republic and has been planted in most parts of the world where the climate is suitable. Although small acreages have been grown in various parts of the United States from time to time, there has been no sustained commercial production. Coriander will grow in a wide range of conditions, but it thrives best in sunny locations where there are rich garden loam of limestone origin and good drainage.

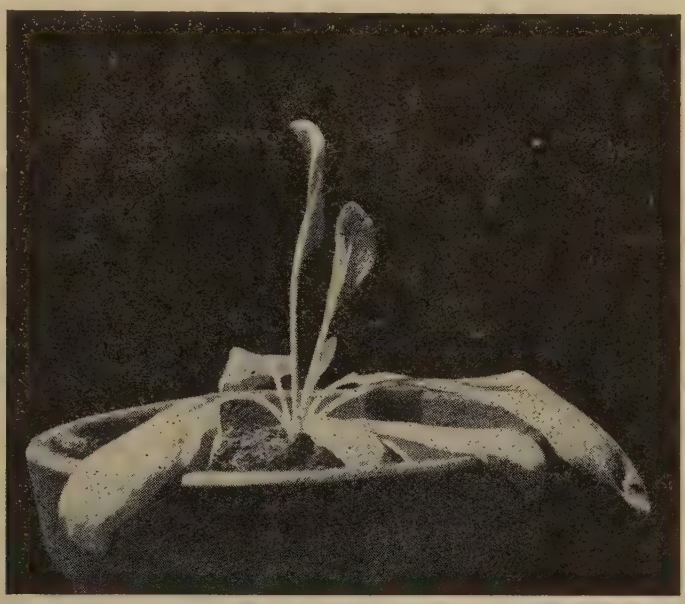

Fig. 5.—Digitalis, *Digitalis purpurea* Linn. (*Photographed by Photographic Division*)

The seeds of this plant germinated on May 31, 1951, or six days after sowing. On the tenth day germination was complete. The percentage of germination was 62. Transplanting was done on June 28, 1951 (table 1).

The seedlings were attacked by a fungus disease, *Fusarium* sp. All diseased seedlings were removed.

When the plants were 72 days old, they were 15.4 centimeters high (table 1). They appeared glabrous; they had a strong smell; and their leaves were divided into almost thread-like divisions. The heavy rain which occurred on August 10, 1951, killed all the plants.

Digitalis, *Digitalis purpurea* Linn., (fig. 5) also known as foxglove, is a fairly hardy European biennial or perennial and has long

been grown for ornamental purposes in flower gardens in the United States. Digitalis leaves and their extract are used as cardiac stimulant for some heart ailments. The plant thrives in ordinary well-drained soils of open texture and ordinary fertility. Sievers said that it grows wild in the general region of the coast range of mountains in the northern Pacific Coast states.

In the present study, the seeds germinated on June 1, 1951. Germination, which was complete after 15 days, was 49 per cent. On June 28, 1951, the seedlings were transplanted.

The plants grew very slowly and all of them, except one, finally died after a heavy rain. The only plant which survived in the pot grew to a height of 17.5 centimeters (table 1). After 358 days, the leaves of the plant were rugose and somewhat downy; they were either long-stalked and ovate to ovate-lanceolate or short-stalked at the base, becoming smaller toward the top of the stem. The plant did not bear any flower. No important pest or disease attacked it.

Fig. 6.—American wormseed, *Chenopodium ambrosioides* Linn. (*Photographed by Photographic Division*)

At the age of 358 days or 11 months and 23 days, the plant was harvested and was dried and treated in the same manner as the dill plant. The dry weight was 1.5 grams for the leaves and 0.5 gram for the roots.

Yields obtained from cultivated digitalis in the United States appear to vary greatly. Occasional yields of more than a ton to an

acre, or 182.50 kilograms to a hectare, of dry leaves are reported from small areas.

American wormseed, *Chenopodium ambrosioides* Linn., (fig. 6) is a coarse, usually annual weed that commonly grows in waste places and often in cultivated ground throughout the eastern and southern parts of the United States. The oil distilled from the seed is used as an anethelmintic, especially against roundworm and hookworm. Sievers noted that the cultivated plant grows well in almost any soil, but a good sandy loam is preferable.

Germination began six days after sowing and was complete in 20 days. Only 6 per cent of the seeds germinated. On June 27, 1951, the seedlings were transplanted.

The plants grew well under local conditions. In spite of the heavy rain that occurred on August 10, 1951, they survived and grew to a height of 60 centimeters, gave alternate leaves with a strong odor, and bore inconspicuous, perfect, greenish flowers.

The pest that attacked the plants was the giant African snail, *Achatina fulica.*[6] The snails were collected and killed. A strong concentration of salt solution placed in split bamboo around the plots checked the attack of the snails.

When the plants were 12 months and 21 days old, they were harvested. The same procedure used with the dill plant was followed in preparing the products. The dry weight of the leaves was 1.5 grams; that of the roots, 0.8 gram; that of the stem, 2.1 grams; and that of the seeds, 0.3 gram.

In the United States it was found that when American wormseed is grown for its seed, about 1,000 pounds of seeds to an acre, or 182.50 kilograms to a hectare, can be obtained.

Stramonium, *Datura stramonium* Linn., (fig. 7) is a poisonous annual that grows as a common barnyard weed in most sections of the United States. The leaves and flowering tops are used especially as a source of hyoscyamin, an important medicinal alkaloid. Sievers found that although stramonium grows wild in a variety of soils, it thrives best under cultivation in rich and rather heavy soil. The plant is readily propagated by seed.

The stramonium seeds germinated five days after sowing. On the tenth day germination was complete. The percentage of germination was 92. Transplanting was done on June 27, 1951 (table 1).

The seedlings were seriously attacked by black fungus, *Curvularia* sp. and orange fungus, *Fusarium* sp. All diseased seedlings were removed from the pots. The plants in the drum were attacked by the giant African snail, *Achatina fulica*. The snails were collected and killed. Only one plant in the pot was saved for study.

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[6] Determination of pests by Dr. S. M. Cendaña of the Department of Entomology.

The leaves of the plant are either large and entire or wavy-toothed; the flowers are large, solitary, and erect or pendulous, with more or less a violet color; the five-toothed calyx sometimes breaks apart near the base or splits lengthwise; the trumpet-shaped corolla has five to ten spreading toothed limbs; the five stamens are all perfect, slightly exerted or not at all; the filaments are slender; the style is long; the stigma is two-lobed; and the fruit has two double-celled caps which are mostly prickly or spiny, usually dry and four-valved at the top, but sometimes fleshy and bursting irregularly with seeds.

The growth and development of the plant was very abnormal. At the age of 61 days, it was 25.6 centimeters high (table 1). It

Fig. 7.—Stramonium, *Datura stramonium* Linn.
(*Photographed by Photographic Division*)

flowered. When it was 93 days or three months old, it was harvested in the same way as the dill. The dry weight was 0.2 gram for the leaves, 0.6 gram for the stem, 0.5 gram for the roots, and 0.2 gram for the seeds.

The actual yield of dry leaves in the United States under favorable conditions is 1,000 to 1,500 pounds to an acre, or 182.50 to 274.35 kilograms to a hectare. The yield of seeds is 2,000 pounds to an acre, or 365.81 kilograms to a hectare.

Fennel, *Foeniculum vulgare* Linn., (fig. 8) is a herbaceous perennial occasionally cultivated as a garden herb in the United States. The dried aromatic fruits, commonly referred to as seeds, are used for flavoring bread, pastry, candies, and liquors and as medicine. A volatile oil is present in the seed and may be obtained by steam distillation. It possesses the characteristic flavor of the seed and is used for flavoring and for medicinal purposes, as stimulant, carminative, and emmenagogue.

Fig. 8.—Fennel, *Foeniculum vulgare* Linn. *(Photographed by Olive's Studio)*

When grown under favorable conditions, the Indian fennel matures when it is about 3½ to 4 feet high. The Moroccan variety requires about three weeks longer to mature and is about 6 feet tall. Sievers found that it grows well in a fairly mild climate and in almost any kind of soil, but it thrives best in nonacid, well-drained loam. It is readily grown from seed but can also be propagated by root and crown division.

The variety used in this study was dulce or sweet fennel, which is propagated by seed. The seeds germinated five days after planting. Germination was complete ten days after planting; 73 per cent of the seeds germinated. The seedlings were transplanted on June 27, 1951 (table 1).

The seedlings were attacked by a fungus, *Helminthosporium* sp. All diseased seedlings were removed. Observation showed that the plants had fairly good development in spite of the heavy rain that occurred on August 10, 1951. The plants survived and were able

to bear flowers the next year, May 13, 1952. When the plants flowered, suckers appeared at their bases.

It was observed that under local conditions the plant grows to a height of 127 centimeters (table 1). At the base of the plant the crowded leaf stalks make a bulb-like enlargement above the ground. This thickened base has an oval form in cross section. The seed is borne on umbels developed on the plant at the same time.

After 298 days, when the seeds were about to mature, a continuous rain caused the death of all the plants.

Fig. 9.—Henbane, *Hyocyamus niger* Linn. (*Photographed by Photographic Division*)

Henbane, *Hyoscyamus niger* Linn., (fig. 9) is a poisonous annual or biennial herb introduced in the United States from Europe and occasionally found as a weed in some of the northern and Great Plains states. The herb contains several alkaloids, the most important of which is hyoscine, which is used in the preparation of important medicines. Extracts from the leaves, seeds, flowers, and tops are used as narcotic, mydriatic, and analgesic and are used in treating mania, hysteria, whooping cough, colic, and urinary incontinence. Sievers stated that the soil and climatic requirements of henbane are very similar to those of belladonna, but the plant is less subject to root decay under poor drainage conditions.

The henbane seeds germinated on May 31, 1951, or six days after sowing. Germination was complete after 12 days. The per-

centage of germination was 92. Transplanting was done on June 27, 1951 (table 1).

The seedlings were seriously attacked by a fungus, *Alternaria* sp. All the affected seedlings were removed; the remaining seedlings were exposed to sunshine for 45 minutes to one hour every day to check the fungus growth.

It was observed that the plants grew to a height of 10.5 centimeters only. They were attacked by crickets, *Gryllus substacens* Walker. The bad weather and the attacks of pests and diseases caused the death of all the plants when they were two months and ten days old.

Horehound, *Marrubium vulgare* Linn., a hardy perennial herb, grows as a common weed in many places in the United States, especially on the Pacific coast. The leaves and flowering tops are useful in treating coughs and dyspnea and as a vermifuge. Their greatest use is in the manufacture of horehound candy, although they are sometimes used for seasoning.

Germination of the horehound seeds began five days after sowing and was complete on the seventeenth day. The percentage of germination was 21. On June 27, 1951, the seedlings were transplanted.

The seedlings were seriously attacked by a fungus disease, *Penicillium* sp. All diseased seedlings were removed. The plants were also attacked by the giant African snail, *Achatina fulica*. The snails were collected and killed.

Horehound, which lived for 65 days, attained a height of only 10.3 centimeters (table 1) and then died.

TABLE 1

Percentage of germination, dates of transplanting and harvesting, and height of the different species

SPECIES	C. A. NUMBER	DATE OF SOWING	DATE OF GERMINATION	GERMINATION PERIOD	TOTAL NUMBER OF SEEDS SOWN	NUMBER OF SEEDS GERMINATED	PERCENTAGE OF GERMINATION	DATE OF TRANSPLANTING	DATE OF HARVESTING	HEIGHT OF PLANTS
		1951	*1951*	*days*				*1951*		*cm.*
1. *Anethum graveolens* Linn.	376	May 25	May 30	5– 7	100	10	10	June 27	Jan. 28, 1952	109.2
2. *Atropa belladonna* Linn.[a]	377	" "	June 7	10–13	100	5	5		April 30, 1951	45.7
3. *Carum carvi* Linn.	378	" "	June 2	8–14	100	15	15	June 27		9.0
4. *Coriandrum sativum* Linn.	379	" "	May 31	6–19	100	62	62	June 28		15.4
5. *Digitalis purpurea* Linn.	380	" "	June 1	7–15	100	49	49	June 28	May 23, 1952	17.5
6. *Chenopodium ambrosioides* Linn.	381	" "	May 31	6–20	100	6	6	June 27	July 13, 1952	60.0
7. *Datura stramonium* Linn.	382	" "	May 30	5–10	100	92	92	June 27	Aug. 30, 1951	25.6
8. *Foeniculum vulgare* Linn.	383	" "	May 30	5–12	100	73	73	June 28		127.0
9. *Hyoscyamus niger* Linn.	384	" "	May 31	6–12	100	92	92	June 27		10.5
10. *Marrubium vulgare* Linn.	386	" "	May 30	5–17	100	21	21	June 27		10.3

[a] Only one seedling survived.

DEVELOPMENT OF SYNTHETIC VARIETIES FROM INBRED LINES OF COLLEGE YELLOW FLINT CORN [1]

FELIPE V. CAGAMPANG

Of three synthetic varieties developed from S_3 lines of College Yellow Flint, Synthetics I and II proved to be better yielders than the parent variety in the wet-season planting of 1952 at Los Baños. Since the results are based on the F_2 performance of the synthetics, further testing of the F_3 and F_4 generations of the synthetics should be conducted.

Although Synthetic I is a better yielder than Synthetic II, the latter is preferred as a crop strain because of its apparent uniformity.

The production of synthetic varieties was suggested by Hayes and Garber (1919). Hayes (1926) reported that the yields of five synthetics, each of which was derived from an open-pollinated variety, ranged from —11.7 to + 16.6 per cent of the yield of the parent varieties.

Kiesselbach (1933), who produced 8- and 16-line synthetics, concluded that though some of the synthetics were as productive as the standard varieties, none was superior. Similarly, Sprague and Jenkins (1943), who developed synthetics whose component lines had been chosen for specific characteristics other than combining ability, found that the advanced generations of these synthetics did not differ significantly in yield from the standard open-pollinated varieties.

Recently, however, Hayes, Rinke, and Tsiang (1944) and Lonnquist (1949) developed synthetics that were generally superior in yielding ability to the open-pollinated varieties. In Mexico, Wellhausen and Roberts (1941) effected the improvement of an open-pollinated variety in the shortest possible time through the production of a double topcross synthetic which produced 26 per cent more grains than the best open-pollinated variety in that locality.

College Yellow Flint is an open-pollinated variety well-adapted to the growing conditions of Los Baños and its vicinity. To improve its yield and possibly reduce its variability, this work on the production of three synthetics of College Yellow Flint was undertaken in the Plant Breeding laboratory of the Department of Agronomy, College of Agriculture Central Experiment Station, Los Baños, Laguna, from June, 1951, to September, 1952.

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[1] Central Experiment Station Contribution No. 1659. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of Dr. Dioscoro L. Umali.

MATERIALS AND METHODS

Inbred lines used. College Yellow Flint was the source of the lines used in this study. The twelve S_3 inbreds used in the three synthetics were selected from a collection of 94 other inbreds developed by the Department of Agronomy for the following reasons: (a) their yield is 75 per cent or more over the College Yellow Flint, as shown by the result of the dry-season planting of 1950, (*b*) they belong to a group of good combiners, as shown by the combining ability test conducted in the wet-season planting of 1950, and (*c*) their vegetative and grain characters are more or less similar to those of College Yellow Flint.

The yield and combining ability of the inbreds used in the three synthetics are shown below: [2]

S_3 INBREDS	HECTARE-YIELD	YIELD IN PERCENTAGE OF COLLEGE YELLOW FLINT	HECTARE-YIELD OF TOPCROSS WITH CUBAN YELLOW FLINT	TOPCROSS YIELD IN PERCENTAGE OF COLLEGE YELLOW FLINT	COMBINING ABILITY
	cavans		*cavans*		
C-14	26.1	83.7	43.3	145.3	high
C-17	25.8	82.7	42.4	141.8	"
C-8	24.7	79.2	40.7	136.2	"
C-35	25.4	81.4	39.1	131.2	"
C-5	24.8	79.5	38.9	130.7	medium
C-28	23.7	76.0	37.1	124.5	"
C-29	24.1	77.2	36.3	121.9	"
C-6	23.4	75.0	34.6	116.0	"
C-10	23.4	75.0	34.0	114.1	low
C-43	24.0	76.9	32.9	110.3	"
C-46	23.4	75.0	31.5	105.7	"
C-12	23.5	75.3	31.4	105.4	"
College Yellow Flint	31.2	100.0	29.8	100.0	

As indicated above, the topcross yields of the inbreds ranged from 105.4 to 145.3 per cent of the yield of College Yellow Flint. Inbreds with topcross yields falling between 145.3 and 131.0 per cent are classified as high combiners; those between 130.0 and 116.0, as medium combiners; and those between 115.0 and 100.0, as low combiners. Although other inbreds were good combiners, they were discarded because their vegetative or grain characteristics did not conform with those of College Yellow Flint.

Making of the single crosses. In the dry season of 1951, the following single crosses were made by controlled hand-pollination:

Group I. High combiners. All possible single cross combinations among S_3 lines C14, C17, C8, and C35: C14 × C17; C14 × C8; C14 × C35; C17 × C8; C17 × C35; and C8 × C35.

[2] Performance test was conducted by the Department of Agronomy.

Group II. Medium combiners. All possible single cross combinations among S_3 lines C5, C28, C29, and C6: C5 × C28; C5 × C29; C5 × C6; C28 × C29; C28 × C6; and C29 × C6.

Group III. Low combiners. All possible single cross combinations among S_3 lines C10, C43, C46, and C12: C10 × C43; C10 × C46; C10 × C12; C43 × C46; C43 × C12; and C46 × C12.

Twelve ears were hand-pollinated for each single cross.

Production of the synthetics. **Synthetic I.** The 72 ears harvested from the six single crosses (C14 × C17, C14 × C8, C14 × C35, C17 × C8, C17 × C35, and C8 × C35) were shelled and bulked. From the bulked seeds of the single crosses, one-half ganta was taken and planted in an isolated plot where the individual plants were allowed to pollinate normally. The harvested seeds (F_1 of the synthetic) from this planting were bulked again and a sample of half a ganta was planted in an isolated plot where the plants were allowed to open-pollinate one another. The seeds of this crop, which represented the F_2 generation of the synthetic, were bulked and used in the performance test.

Synthetic II. The 72 ears harvested from the six single crosses (C5 × C28, C5 × C29, C5 × C6, C28 × C29, C28 × C6, and C29 × C26) were shelled and bulked. The same procedure for producing Synthetic I was followed for Synthetic II.

Synthetic III. The single cross seeds of C10 × C43, C10 × C46, C10 × C12, C43 × C12, C46 × C12, and C43 × C46 were handled in the same manner as those of Synthetic I.

Performance test of the synthetics. In the wet-season planting of 1952 the three synthetic varieties and College Yellow Flint were planted to compare their performance. The randomized block design with four replications was used in the statistical interpretation of the grain yield. Each plot had eight rows, one meter apart; each row had 14 hills, 60 centimeters apart. The yield of grain of each plot was based on the harvest of the 14 two-plant hills of the six rows of each plot. The harvest of the rows at both ends of the plot and the hills at both ends of each row was discarded.

The percentages of root and plant lodging and of dropped ears were based on the plants of block 4 only.

One hundred ears picked at random from the harvest of one plot were used to determine the mean length of the husked ears and the number of rows of grain.

The shelled grains of each plot were weighed at 15 per cent moisture. The yield was expressed in 57-kilogram cavans.

EXPERIMENTAL RESULTS

Of the three synthetic varieties, Synthetic I, which yielded 118.2 per cent more than College Yellow Flint, was significantly the best yielder. This is to be expected since the four S_3 lines used were all

high combiners (table 1). Synthetics I and II were significantly better grain producers than College Yellow Flint. There was no appreciable difference in grain yield between Synthetic III and College Yellow Flint.

The good yielding capacity of Synthetics I and II may be attributed to their having significantly long ears and more grain rows than either Synthetic III or College Yellow Flint (table 1). It was also observed that College Yellow Flint had a higher percentage of root lodging and of dropped ears than either Synthetic I or II. The damage caused by pests and diseases on the four strains was negligible.

Although Synthetic I was a better yielder than Synthetic II, the latter, because of its uniformity in ear and grain characters and in maturity, is more desirable for planting purposes. The variability of Synthetic I will be objected to by many farmers who are used to the more uniform old varieties.

The performance of three synthetics shows that there is a direct relation between topcross yield or combining ability of the inbreds and the yielding capacity of the synthetic developed from the inbreds. Synthetic I of Group I was the best yielder; Synthetic II of Group III was third in yield.

DISCUSSION

Factors that determine the yield of advanced generations of synthetics. According to Sprague and Jenkins (1943), the four factors that determine the yield of advanced generations of synthetic varieties are (*a*) the number of lines involved, (*b*) the mean yield of these lines, (*c*) the mean yield of all their possible single crosses, and (*d*) the percentage of self-pollination. Since corn is a naturally cross-pollinated plant, the last factor is of the least significance.

Theoretical production of F_1 and F_2 generations. Wright (1922) has pointed out that with random mating, the vigor and yielding capacity of the F_2 of a hybrid can be calculated from the formula *1/n* (hybrid-inbred), where "n" is number of lines involved and "hybrid" refers to the average performance of all the possible single cross combinations among the inbreds or parental lines used and "inbred" refers to the average performance of all the inbred lines themselves. For example, if two inbred lines, each yielding 50 per cent as much as the open-pollinated variety, yield 130 per cent when crossed, the reduction in yield of the F_2 from that of the F_1 is *1/nth,* or one-half of the difference between 130 and 50 per cent. The yield of the F_2, therefore, is 90 per cent of that of the open-pollinated variety. But if four lines with the same yielding ability of 50 per cent are used and the average yield of all the possible single crosses is also 130 per cent, the decline in yield of the F_2 generation would be one-fourth of the difference, or 20, thereby giving F_2 a calculated yield of 110 per cent.

Wright's formula of the reduction in yield in the F_2 was adequately corroborated by Neal (1935) who compared the yields of the F_1 and F_2 generations of ten single crosses, four three-way crosses, and two double crosses. The average decrease in yield was 29.5 per cent for the single crosses, 23.4 for the three-way crosses, and 15.8 for the double crosses; their computed reductions in yield were 31.1, 21.0, and 15.2 per cent, respectively. The differences of the actual computed yields were very slight.

Genetic diversity in the F_2 and subsequent generations. According to Pearson and Hardy's law,[3] random-bred populations not subjected to any population pressure attain genetic equilibrium or stability in the F_2 generation. Therefore, in the absence of any form of selection, no reduction in yield is expected in the succeeding generations of the F_2.

Kieselbach (1933) compared the F_1, F_2, and F_3 yields of 21 single crosses. The average yields of the F_1, F_2, and F_3 generations were 57.0, 36.4, and 37.8 bushels, respectively. The difference between the actual yield of the F_2 and F_3 and the theoretical yield was insignificant.

Since the F_2 and subsequent generations would perform similarly if the population were allowed to breed *inter se*, Synthetics I, II, and III in this experiment were subjected to performance tests as early as in their second generation. However, it is imperative that the three synthetics be maintained in isolated plots and tested further in the F_3, F_4, and F_5 generations.

Number of inbred lines to be used in synthetics. In the past the tendency in the development of synthetics was to use a large number of inbred lines so that the reduction in yield in the advanced generations would be less. In fact, in all the early works in synthetics, eight or more lines were used. Hayes (1926) used eight and seventeen lines; Kiesselbach (1933), eight and sixteen; Sprague and Jenkins (1943), sixteen and twenty-four.

However, Kinman and Sprague (1945) reported that, in general, the efficient number of lines to be included in a synthetic variety will depend on the range of combining ability of the available inbreds. Judged by their study, smaller numbers of lines (four to six) are more efficient especially if the lines are productive and they yield at least 75 per cent of the open-pollinated variety.

Wellhausen and Roberts (1941) advocate the use of four to six productive lines which are good combiners instead of a large number of lines of unknown productivity. They pointed out that it is much easier to obtain four inbred lines that yield well in all possible single cross combinations than ten or sixteen, and that the mean yield of all the possible single crosses of four or five good combiners will be higher than that of a large number of low combiners.

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[3] SRB, A. M., AND R. D. OWEN. 1952. General genetics. xx +443 p. California: W. N. Freeman and Co.

The number of lines which constitute each of the three synthetics developed in this work was reduced to four, not only because the combining ability range of available lines so demanded, but also because the four lines in each group were similar in ear and grain characters and in maturity. The greatest amount of hybrid vigor is generally derived by using unrelated lines; however, if the inbred lines that are combined are greatly different, the resulting F_2 may be extremely variable in vegetative vigor, ear and grain characters, and maturity. Synthetic II was remarkable in its uniformity, especially in maturity, possibly because the four lines that made it were not extremely unrelated.

Generations of inbreeding of lines for production of synthetic varieties. Two possible ways suggested by Kinman and Sprague (1945) for increasing the yield level of a synthetic involving a given number of lines are by (*1*) increasing the F_1 mean yield and (*2*) increasing the inbred mean yield. The latter is easily accomplished through the use of S_1 lines, which, of course, yield more than long-time inbreds. Since the combining ability of a line in topcross has been shown to be relatively steady after the S_1 generation, little or nothing would be gained by additional selfing as far as synthetic production is concerned.

Without overlooking the advantages of using S_1 lines for synthetics, S_3 lines were used in this experiment because the objective is not only to increase the yield but also to impart a certain degree of uniformity to the synthetics by using lines of definite characteristics or individuality which can be detected only after three generations of selfing. In the last two planting seasons, College Yellow Flint, despite the use of mass-selected seeds, showed considerable variability in grain characters and more so in maturity. It is a common observation that a field of College Yellow Flint flowers in three weeks; a uniform strain flowers within a week. Such variability is to be expected since College Yellow Flint is usually planted side by side with foreign varieties and other native strains.

As expected, with the use of S_3 lines, the synthetic varieties developed were relatively less variable than the open-pollinated College Yellow Flint. The uniformity in ear and grain characters was remarkable especially in Synthetic II which tasseled within a period of seven days (July 16 to 23, 1952).

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TABLE 1

Performance of the three synthetics and College Yellow Flint

PLANT CHARACTER	SYNTHETIC I	SYNTHETIC II	SYNTHETIC III	COLLEGE YELLOW FLINT
Percentage of root lodging	5.3	4.6	6.3	10.8
Percentage of stalk lodging ..	1.8	1.5	2.4	2.3
Percentage of dropped ears ...	0.0	0.0	0.0	1.6
Mean length of ears in centimeters	18.8 ∓ 0.06	18.5 ∓ 0.02	18.5 ∓ 0.05	18.4 ∓ 0.09
Average number of rows of grain on ear	13.92	13.64	13.58	13.54
Damage by pests and diseases	Negligible	Negligible	Negligible	Negligible
Hectare-yield in cavans (57 kilograms)	36.57	35.75	31.32	30.95
Hectare-yield in percentage of College Yellow Flint	118.2	115.5	101.2	100.0

L. S. M. D. for hectare-yield = 2.3 cavans.

A COMPARISON OF SOME AROMATIC TOBACCO VARIETIES [1]

VICTOR C. RIMANDO

WITH ONE TEXT FIGURE

The germination period of seven aromatic tobacco varieties studied ranged from six to eight days. At transplanting, Dixie Bright 101 (CA 412), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) were the tallest, and CA 416 (Turkish), the shortest. The Turkish varieties matured earlier than the Virginia varieties but were more susceptible to pests and diseases.

CA 419 (Turkish) gave the most number of leaves to a plant, whereas CA 417 (Turkish) produced the least. Vamorr 50 (CA 415) produced the longest middle standard leaf, but Dixie Bright 101 (CA 412), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) produced the widest. CA 419 (Turkish) produced the greatest number of flower branches, and CA 417 (Turkish), the least. Dixie Bright 101 (CA 412) of the Virginia varieties produced the greatest yield, and CA 417 of the Turkish varieties, the least.

The quality of sun-cured leaf of the different varieties was considered very good by a manufacturer of aromatic cigarettes. The Turkish tobacco leaf, however, was superior to the Virginia tobacco leaf in burning quality and aroma.

To select a standard variety of aromatic tobacco which may be produced in the Philippines and thus lower the importation of aromatic tobacco leaf, seeds of outstanding aromatic tobacco varieties were obtained from the United States Department of Agriculture and from Turkey and the yields, quality of sun-cured leaves, and other important characters were studied from November, 1951, to June, 1952. This work was conducted in the Department of Agronomy of the Central Experiment Station of the College of Agriculture, Los Baños, Laguna.

REVIEW OF LITERATURE

As early as 1919, Leaño grew seven introduced aromatic tobacco varieties with satisfactory results. In spite of the unfavorable climatic conditions in the College, he found that the color, aroma, size, and shape of leaves were similar to those of the varieties grown in the United States.

Paguirigan and Ramos (1932, 1933) found that the most suitable climate for the culture of cigarette tobacco is the First Type, which is characterized by two pronounced seasons: dry in winter, November to February, and spring, March to May, and wet in summer

[1] Central Experiment Station Contribution No. 1660. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture. Prepared in the Department of Agronomy under the direction of Dr. Pedro A. David.

and autumn, June to October. That aromatic tobacco is adapted to soils of average fertility was corroborated by Paguirigan and Tugade in 1940 and Gutierrez in his studies on Virginia tobacco varieties in 1949.

Ramos and Palafox (1933) reported that on the basis of the plants in the field and the quality of cured leaf products, Turkish tobacco is a type by itself. It thrives in a wide range of well-drained soils. Excessive moisture in the soil is detrimental to the quality of its leaves. Soils rich in organic matter tend to increase the size of the leaves and make them lose their peculiar aroma, whereas poorer soils insure the desirable qualities.

MATERIALS AND METHODS

Varieties used. Thirteen aromatic tobacco varieties of the Virginia and Turkish types were obtained from the U. S. Department of Agriculture, through the American Embassy, Manila. Six of them did not germinate; as a result, only the following seven varieties (with their CA numbers) were studied:

a. Virginia varieties.
   CA 412, Dixie Bright 101
   CA 413, Dixie Bright 102
   CA 414, Vamorr 48
   CA 415, Vamorr 50

b. Turkish varieties.
   CA 416, U.S.D.A. (P.I. 170,566 and P.Q. XO4344)
   CA 417, U.S.D.A. (P.I. 170,567 and P.Q. XO4345)
   CA 419, U.S.D.A. (P.I. 175,790 and P.Q. XO8865)

Sowing. Clay pots, seven and eight inches in diameter, were filled with sterilized, sifted garden soil. The pots were placed in a tub of water until the surface of the soil in each pot was moist. On November 12, 1951, one part of the seeds of each variety was mixed with 20 parts of fine wood ash, and the mixture was evenly scattered on the surface of the soil in each pot. The seeds were slightly pressed into the soil. The pots were put back into the tub, removed, and placed on racks with legs coated with ordinary engine oil to protect the seeds from ants.

Pricking. On December 4, 1951, when the seedlings had two or three pairs of leaves, they were pricked five centimeters apart in seed boxes. The flats were placed in a shed and moderately watered every morning. The seedlings were gradually exposed to the sun to harden. All weeds were removed and pests were controlled by hand-picking.

Preparation of the land. The field of well-drained and fairly level clay loam, which had been previously planted to tobacco, was first tilled with a native plow in late September, 1951, and replowed two months later. It was plowed for the third time on January 3,

1952, with a tractor and was then harrowed and thoroughly prepared for planting.

Transplanting. The seedlings were transplanted in the field late in the afternoon of January 5, 1952. Three replications of 45 plants a plot were made for each variety in a randomized block method of experimental design. Uniformly sized seedlings were transplanted by hand 70 centimeters from each other in rows 80 centimeters apart. The seedlings were placed in the holes singly, no deeper than in the seedbed, with the roots spreading out and the surrounding soil pressed lightly and evenly. To prevent wilting, the newly transplanted seedlings were watered immediately and shaded with banana leaves for a week. All the missing hills were replanted after three days and whenever necessary.

Care and cultivation. The transplanted plants were watered daily for ten days. The first cultivation was done ten days after transplanting. Subsequent cultivations with a hoe were done weekly. When the plants were about 25 to 30 centimeters high, they were hilled-up.

Worming. The worms were controlled by spraying the plants weekly for six weeks with "Gesarol" (50% DDT)[2] and by hand-picking every morning or late in the afternoon until the leaves of the plants were ready for harvesting.

Harvesting. Harvesting by priming, that is, picking the leaves as they matured or changed from green to light green, was begun on March 14, 1952, about nine weeks after transplanting, and was continued weekly. One to three leaves were primed from a plant at a time until all the leaves of the plants were harvested.

Poling. Before the leaves were poled, they were classified according to size, soundness, and degree of maturity. The leaves were wilted according to the method used by Baltazar (1937). A stick sharpened with a bolo was passed through the petioles of the leaves. The leaves were strung alternately, with the midribs towards the outside, and spaced about two centimeters apart.

Curing. The method of sun-curing described by Collins (1940) was followed. The poled leaves were hung on a rack made of two parallel bamboos held one meter above the ground by vertical poles. The rack was five meters in length and more than a meter in width. So that the leaves could receive the maximum amount of sunlight during the day, the length of the rack was arranged in a north and south direction. Tarpaulin was placed over the curing rack at night and during rainy days to protect the drying tobacco leaves from dew and rain. The cover was removed early in the morning and replaced late in the afternoon. This operation was continued until the tobacco leaves were completely dried and cured.

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[2] Recommended and supplied by Dr. G. B. Viado of the Department of Entomology.

Sorting and weighing of the cured leaves. The sun-cured leaves were taken from the rack early in the morning and were classified according to color, size, and soundness. They were bundled into groups of 30 to 35 leaves and then placed in separate boxes. The cured leaves of the different plots were weighed.

Other quantitative characters studied. Measurements and statistical analyses of the following quantitative characters of the different varieties were made: (a) height of plants, (b) number of leaves harvested, (c) character of petiole and size of leaves, (d) form or shape of middle-standard leaves, (e) texture and color of leaves, (f) position of leaf on stem, (g) character of leaf surface, (h) length and character of internodes, (i) branching habit or tendency to produce suckers, (j) color of corolla and flowering habits, (k) resistance to pests and diseases, and (1) maturity of plants.

Quality of sun-cured leaf. Samples of cured leaves of each variety were submitted to the Amos Peckham Tobacco Co., (Phil.) Inc., Parañaque, Rizal, for determination of quality.

RESULTS AND DISCUSSION

In the seedbed. The seeds of six Turkish varieties, Samsun (CA 403), CA 418, CA 420, CA 421, CA 422, and CA 423, failed to germinate (table 1). Vamorr 48 (CA 414) germinated six days after seeding; Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 50 (CA 415), CA 417, and CA 419, seven days; and CA 416, eight days. The seedlings of the remaining Turkish varieties, CA 416, CA 417, and CA 419, were apparently more susceptible to frog-eye disease than the Virginia varieties, Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), and Vamorr 50 (CA 415). The infection, however, did not interfere much with normal growth.

The age of the seedlings when transplanted ranged from 46 to 48 days, but the differences in their average heights were highly significant (table 2). Dixie Bright 101 (CA 412), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) were the tallest. CA 417 was a poor second, followed by CA 419 and Dixie Bright 102 (CA 413). CA 416 seedlings were the shortest.

Appearance of plants. The differences in height of plants, color, and shape of leaves were very marked four weeks after transplanting.

Height of plants at maturity. The differences in the mean heights of the plants at maturity were highly significant. Table 3 shows that Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), Vamorr 50 (CA 415), and CA 419 were taller than CA 415 and CA 417.

Average number of harvested leaves. Table 4 shows that the average number of leaves harvested from a plant of the different varieties was highly significant. CA 419 gave the greatest number of harvested leaves; Dixie Bright 101 (CA 412) was second, followed by Vamorr 48 (CA 414). Dixie Bright 102 (CA 413) and Vamorr

50 (CA 415) gave practically the same number of harvested leaves, followed by CA 416. CA 417 produced the least.

Character of petiole and dimension of middle-standard leaf. The different varieties did not show differences in the character of the petiole; all had sessible leaves, though CA 416 and CA 417 had wider leaf bases than the others (fig. 1).

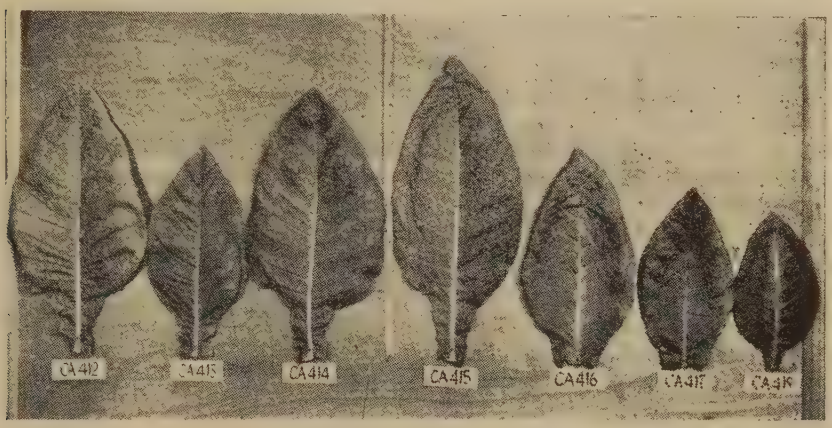

Fig. 1.—Typical middle-standard leaves of the different varieties of tobacco tested. (*Photographed by Mr. G. C. Laforteza, Los Baños, Laguna*)

A comparison of the mean lengths of the middle-standard leaves showed that their variation was highly significant (table 5a). Vamorr 50 (CA 415) produced the longest middle leaf. Dixie Bright 101 (CA 412) and Vamorr 48 (CA 414) gave statistically the same length of leaves, and so did Dixie Bright 102 (CA 413) and CA 416, which were followed by CA 417. CA 419 produced the shortest.

The differences in average width of the middle-standard leaves were highly significant (table 5b). Dixie Bright 101 (CA 412), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) gave the widest middle-standard leaves, followed by Dixie Bright 102 (CA 413) and CA 416. CA 417 and CA 419 exhibited the narrowest leaves of practically the same width.

Shape of middle-standard leaf. Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), CA 417, and CA 419 produced ovate leaves, whereas Vamorr 50 (CA 415) and CA 416 produced elliptic-ovate leaves (fig. 1).

Position of leaves on stem. The young leaves of Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) were slightly erect, whereas those of CA 416, CA 417, and CA 419 were erect (table 6). When these leaves matured and were ready for priming, their position varied from slightly erect to horizontal. The leaves of Dixie Bright 101 (CA

412) and Dixie Bright 102 (CA 413) changed in position from slightly erect to slightly horizontal; those of Vamorr 48 (CA 414) became horizontal; and those of Vamorr 50 (CA 415), horizontal with drooping tips. The Turkish varieties, CA 416, CA 417, and CA 419, exhibited slightly erect leaves at maturity.

Character of leaf surface. The leaf surfaces of Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), and Vamorr 50 (CA 415) were wavy; those of CA 416 and CA 417 were only slightly wavy; and those of CA 419 were smooth and oily (table 6).

Color of leaf. The colors of the young leaves are given in table 6. Dixie Bright 101 (CA 412) and Dixie Bright 102 (CA 413) exhibited light green leaves, and the rest of the varieties had green leaves. The different varieties, however, changed in color at harvesting time. The leaves of Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), and CA 419 turned yellowish green at maturity, and Vamorr 48 (CA 414), Vamorr 50 (CA 415), CA 416, and C A417 turned light green.

Texture of leaf. The varieties differed in texture of leaf (table 6). The leaves of Vamorr 48 (CA 414) and Vamorr 50 (CA 415) were very gummy; those of Dixie Bright 101 (CA 412) and Dixie Bright 102 (CA 413), appreciably less gummy; and those of CA 416, CA 417, and CA 419, only slightly gummy.

Length of internode. Table 7 shows that the mean lengths of internodes of the plants at maturity were significantly different from each other. Dixie Bright 101 (CA 412) and Dixie Bright 102 (CA 413) had the longest internodes. The rest did not vary significantly from each other, except CA 417, which had the shortest internode.

Branching habits. The mean counts of the suckers produced at maturity were highly significant (table 8). Dixie Bright (CA 412) suckered the most, and CA 416 and CA 417 suckered the least.

Flowering habits. Table 9 shows the variation in color of the newly opened flowers of the different varieties. According to Ridgway's *Color Standards and Color Nomenclature,* Dixie Bright 101 (CA 412) and Dixie Bright 102 (CA 413) exhibited thulite pink corollas; Vamorr 48 (CA 414) and Vamorr 50 (CA 415), rosolane pink; CA 416 and CA 417, spinel pink; and CA 419, cameo pink.

The mean counts of flower branches at maturity were highly significant (table 9). CA 419 produced the most flower branches. Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), Vamorr 50 (CA 415), and CA 416 had the same number of branches, and CA 417, the least.

Resistance to pests and disease. The tobacco plants, from germination to priming, were attacked by cutworms, *Prodenia litura* Fabr. and *Heliothis armigera* Hubner.[3] The leaves of all the varieties in the seedbed and in the field were equally affected. The da-

[3] Identified by Dr. S. M. Cendaña of the Department of Entomology.

mage on the leaves was greatly minimized by spraying them with "Gesarol". Seedlings of the Turkish varieties, CA 416, CA 417, and CA 419, were stunted by the tobacco stem borer, *Gnorimoschema heliopa* Low.[4] The affected plants were rogued and replaced with healthy seedlings.

The tobacco diseases found were the frogeye disease caused by *Cercospora nicotianae* Ell. & Evht., root knot *Heterodera marioni* (Cornu), and curling and mottling of leaves.[5] There was a greater degree of infection on the Turkish varieties than on the Virginia varieties. The stunted plants which were later found to be affected by root knot were uprooted and replaced with vigorous-looking seedlings.

Maturity of plants. Statistical analysis of the mean periods from seeding to maturity of the plants shows that the differences were highly significant (table 10). The Turkish varieties matured earlier than the Virginia varieties.

Yield. The yields of the varieties are shown in table 11. The mean yields of 45 plants of each variety were significantly different from each other. Dixie Bright 101 (CA 412) gave the greatest yield, and Dixie Bright 102 (CA 413), Vamorr 48 (414), and Vamorr 50 (CA 415) ranked second. The other three varieties, which did not vary in yield from each other, gave the least. The yield of the four Virginia varieties was greater than that of the filler type of tobacco varieties reported by Alambra.[6] However, these Virginia varieties gave less yield than those studied by Paguirigan and Ramos (1933).

The Turkish varieties, CA 416, CA 417, and CA 419, gave the same yields, which were much lower than that reported by Ramos and Palafox (1933). It is possible that the performance of the introduced Turkish varieties may improve as they become acclimatized to Philippine conditions.

Quality of sun-cured leaf. The quality of sun-cured leaf, which determines the grade of aromatic leaf tobacco, was based on color, texture, and aroma.[7] A comparison of the cured leaves of the Turkish varieties, CA 416, CA 417, and CA 419, and the Virginia varieties, Dixie Bright 101 (CA 412), Dixie Bright 102 (CA 413), Vamorr 48 (CA 414), and Vamorr 50 (CA 415), was difficult because of variations in color, texture, aroma, and burning qualities (table 12). CA 419, however, was decidedly the best as regards quality leaf tobacco. It produced the most number of golden yellow leaves with smooth and silky laminae and had a characteristic sweetish

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[4] Identified by Dr. S. M. Cendaña of the Department of Entomology.

[5] Determined by Dr. F. T. Orillo of the Department of Plant Pathology.

[6] ALAMBRA, TRANQUILINO C. A comparative study of ten introduced tobacco varieties. (Thesis presented for graduation from the College of Agriculture, November, 1950. Unpublished.)

[7] The writer wishes to acknowledge the help extended by Mr. C. Arnold Hall, president of the Amos Peckham Tobacco Co. (Phil.), Inc., in determining the quality of cured tobacco leaf.

aroma which is very desirable for blending purposes. CA 416 and CA 417 had the same color, texture, and aroma, but the leaves of CA 417 had a better burning quality.

Although Dixie Bright 101 (CA 412) compared favorably with the Turkish varieties as far as quality leaf was concerned, it lacked the peculiar aroma of the Turkish leaf tobacco. Nevertheless, it produced the best quality leaf tobacco among the Virginia varieties studied. Dixie Bright 102 (CA 413) also gave a good quality leaf tobacco but was inferior to Dixie Bright 101 (CA 412) in color of cured leaf. Vamorr 48 (CA 414) and Vamorr 50 (CA 415) produced leaves that were rather poor in color, texture, aroma, and burning quality, but the body of their laminae was suitable for the manufacture of aromatic cigarettes.

The different varieties were in general acceptable to the aromatic cigarette manufacturers in Manila and were graded as follows: CA 419 (Turkish), first; CA 417 (Turkish), second; CA 416 (Turkish), third; Dixie Bright 101 (CA 412), fourth; Dixie Bright 102 (CA 413, fifth; and Vamorr 48 (CA 414) and Vamorr 50 (CA 415), last.

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TABLE 1

Seeding and germination period of the different varieties

VARIETIES	DATE SOWN	DATE GERMINATED	NO. OF DAYS REQUIRED FOR GERMINATION
CA 403, Samsun (Turkish) ...	Nov. 12, 1951	No germination	
CA 412, Dixie Bright 101	do	Nov. 19, 1951	7
CA 413, Dixie bright 102	do	do	
CA 414, Vamorr 48	do	Nov. 18, 1951	7
CA 415, Vamorr 50	do	Nov. 19, 1951	6
CA 416, Turkish tobacco	do	Nov. 20, 1951	7
CA 417, do	do	Nov. 19, 1951	8
CA 418, do	do	No germination	7
CA 419, do	do	Nov. 19, 1951	7
CA 420, do	do	No germination	
CA 421, do	do	do	
CA 422, do	do	do	
CA 423, do	do	do	

TABLE 2

Age and mean height of the seedlings at transplanting

VARIETIES	AGE OF PLANTS	MEAN HEIGHT OF REPLICATIONS			TOTAL	MEAN
		1	2	3		
	days	*cm.*	*cm.*	*cm.*	*cm.*	*cm.*
CA 412, Dixie Bright 101	47	8.1	8.3	8.2	24.6	8.20
CA 413, Dixie Bright 102	47	4.7	5.0	5.1	14.8	4.93
CA 414, Vamorr 48	48	8.0	8.3	8.5	24.8	8.26
CA 415, Vamorr 50	47	8.2	8.2	8.3	24.7	8.23
CA 416, Turkish tobacco	46	4.4	4.2	4.3	12.9	4.30
CA 417, do	47	5.7	6.0	6.1	17.8	5.93
CA 419, do	47	5.3	5.2	5.3	15.8	5.26
TOTAL		44.4	45.2	45.8	135.4	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties ...	6	54.40	9.07	453.50	3.00	4.82
Replications .	2	0.14	0.07			
Error	12	0.21	0.02			
Total	20	54.75				

L.S.M.D. = 0.25.

TABLE 3

Comparative heights of plants at maturity

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
	cm.	*cm.*	*cm.*	*cm.*	*cm.*
CA 412, Dixie Bright 101	132.0	138.1	145.1	415.1	138.37
CA 413, Dixie Bright 102	119.3	121.6	122.1	363.0	121.00
CA 414, Vamorr 48	123.9	121.1	124.2	369.2	123.07
CA 415, Vamorr 50	118.2	120.0	117.1	355.3	118.43
CA 416, Turkish tobacco ..	74.4	71.7	71.9	218.0	72.67
CA 417, do ..	63.8	64.1	61.5	189.4	63.13
CA 419, do ..	120.2	120.6	125.3	366.1	122.03
Total	751.8	757.2	767.1	2276.1	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties ...	6	11,319.38	1,886.56	6.77	3.00	4.82
Replications .	2	17.21	8.61			
Error	12	3,340.32	278.36			
Total	20	14,676.91				

L.S.M.D. = 29.68.

TABLE 4

Comparative numbers of leaves harvested to a plant

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
CA 412, Dixie Bright 101	28.9	30.0	30.3	89.2	29.73
CA 413, Dixie Bright 102	27.2	27.8	27.8	82.8	27.60
CA 414, Vamorr 48	28.6	28.2	28.9	85.7	28.57
CA 415, Vamorr 50	27.3	27.5	27.1	81.9	27.30
CA 416, Turkish tobacco ..	20.7	19.8	19.9	60.4	20.13
CA 417, do ..	16.1	16.3	15.8	48.2	16.07
CA 419, do ..	32.8	32.1	33.3	98.2	32.73
Total	181.6	181.7	183.1	546.4	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties ...	6	609.60	101.60	441.74	3.00	4.82
Replications .	2	0.20	0.10			
Error	12	2.79	0.23			
Total	20	612.59				

L.S.M.D. = 0.85.

TABLE 5a

Comparative lenghts of mature middle-standard leaves

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
	cm.	*cm.*	*cm.*	*cm.*	*cm.*
CA 412, Dixie Bright 101	47.1	49.5	49.1	145.7	48.57
CA 413, Dixie Bright 102	38.5	37.8	38.2	114.5	38.17
CA 414, Vamorr 48	39.5	54.2	50.0	143.7	47.57
CA 415, Vamorr 50	47.5	50.8	54.5	152.8	50.93
CA 416, Turkish tobacco ..	38.0	38.2	39.5	115.7	38.57
CA 417, do ..	32.5	35.0	32.5	100.0	33.33
CA 419, do ..	32.2	29.0	32.5	93.7	31.23
Total	275.3	294.5	296.3	866.1	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties ...	6	1,113.71	185.62	130.72	3.00	4.82
Replications .	2	38.71	19.36			
Error	12	17.05	1.42			
Total	20	1,169.47				

L.S.M.D. = 1.87.

TABLE 5b

Comparative widths of mature middle-standard leaves

VARIETIES	REPLICATIONS 1	2	3	TOTAL	MEAN
	cm.	*cm.*	*cm.*	*cm.*	*cm.*
CA 412, Dixie Bright 101	28.0	27.5	28.6	84.1	28.03
CA 413, Dixie Bright 102	23.5	19.0	24.5	67.0	22.33
CA 414, Vamorr 48	26.0	27.5	27.0	80.5	26.83
CA 415, Vamorr 50	27.5	28.5	26.0	82.0	27.33
CA 416, Turkish tobacco ..	20.5	23.0	21.5	65.0	21.66
CA 417, do ..	16.5	18.6	17.3	52.4	17.46
CA 419, do ..	18.5	15.5	17.5	51.5	17.16
Total	160.5	159.6	162.4	482.5	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F 0.05	0.01
Varieties ...	6	377.01	62.84	23.89	3.00	4.82
Replications .	2	0.59	0.30			
Error	12	31.60	2.63			
Total	20	409.20				

L.S.M.D. = 2.88.

TABLE 6

Position of leaf on stem, character of leaf surface, color, and texture of leaf

VARIETIES	POSITION ON THE STEM		CHARACTER OF LEAF SURFACE	COLOR		TEXTURE OF LEAF	
	Young leaf	Mature leaf		Young leaf	Mature leaf	Pubescence	Gumminess
CA 412, Dixie Bright 101 ..	Slightly erect	Slightly horizontal	Wavy	Light green	Yellowish green	Hairy	Gummy
CA 413, Dixie Bright 102 ..	Slightly erect	Slightly horizontal	Wavy	Light green	Yellowish green	Hairy	Gummy
CA 414, Vamorr 48	Slightly erect	Horizontal	Wavy	Green	Light green	Very hairy	Very gummy
CA 415, Vamorr 50	Slightly erect	Horizontal with drooping tip	Wavy	Green	Light green	Very hairy	Very gummy
CA 416, Turkish tobacco ..	Erect	Slightly erect	Slightly wavy	Green	Light green	Few hairs	Slightly gummy
CA 417, do	Erect	Slightly erect	Slightly wavy	Green	Light green	Few hairs	Slightly gummy
CA 419, do	Erect	Slightly erect	Smooth	Green	Yellowish green	Few hairs	Slightly gummy

TABLE 7

Comparative lengths of internodes at maturity

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
	cm.	*cm.*	*cm.*	*cm.*	*cm.*
CA 412, Dixie Bright 101	4.3	4.4	4.3	13.0	4.33
CA 413, Dixie Bright 102	3.8	4.2	4.1	12.1	4.03
CA 414, Vamorr 48	3.6	3.2	3.9	10.7	3.57
CA 415, Vamorr 50	3.3	4.1	3.9	11.3	3.77
CA 416, Turkish tobacco ..	3.8	4.1	3.3	11.2	3.73
CA 417, do ..	2.6	3.1	2.8	8.5	2.83
CA 419, do ..	3.1	3.6	3.3	10.0	3.33
Total	24.5	26.7	25.6	76.8	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties	6	4.22	0.70	8.75	3.00	4.82
Replications ..	2	0.34	0.17			
Error	12	0.93	0.08			
Total	20	5.49				

L.S.M.D. = 0.50.

TABLE 8

Comparative numbers of suckers at maturity

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
CA 412, Dixie Bright 101	12.3	11.9	12.1	36.3	12.10
CA 413, Dixie Bright 102	10.2	11.6	9.8	31.6	10.53
CA 414, Vamorr 48	6.6	7.2	6.0	19.8	6.60
CA 415, Vamorr 50	8.3	7.6	7.9	23.8	7.93
CA 416, Turkish tobacco ..	3.2	5.1	3.9	12.2	4.07
CA 417, do ..	4.5	5.5	4.6	14.6	4.87
CA 419, do ..	9.1	9.3	9.8	28.2	9.40
Total	54.2	58.2	54.1	166.5	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties	6	157.21	26.20	79.39	3.00	4.82
Replications ..	2	1.56	0.78			
Error	12	3.99	0.33			
Total	20	162.76				

L.S.M.D. = 1.02.

TABLE 9

Color of corolla at flowering time and number of branches of flower heads at maturity

VARIETIES	COLOR OF COROLLA	BRANCHES OF FLOWER HEADS OF REPLICATIONS			TOTAL	MEAN
		1	2	3		
CA 412, Dixie Bright 101	Thulite pink	7.3	8.1	8.1	23.5	7.83
CA 413, Dixie Bright 102	Thulite pink	7.5	7.9	7.3	22.7	7.57
CA 414, Vamorr 48	Rosolane pink	7.0	7.2	6.9	21.1	7.03
CA 415, Vamorr 50	Rosolane pink	8.2	7.7	7.8	23.7	7.90
CA 416, Turkish tobacco	Spinel pink	7.9	7.4	8.0	23.3	7.77
CA 417, do	Spinel pink	5.9	5.6	5.9	17.4	5.80
CA 419, do	Cameo pink	8.6	8.8	9.3	26.7	8.90
TOTAL		52.4	52.7	53.3	158.4	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties	6	16.20	2.70	24.55	3.00	4.82
Replications	2	0.06	0.03			
Error	12	1.27	0.11			
Total	20	17.53				

L.S.M.D. = 0.59.

TABLE 10

Comparative periods from seeding to maturity

VARIETIES	REPLICATIONS			TOTAL	MEAN
	1	2	3		
	days	*days*	*days*	*days*	*days*
CA 412, Dixie Bright 101	191.9	190.5	191.5	573.9	191.30
CA 413, Dixie Bright 102	187.3	188.4	188.1	563.8	187.93
CA 414, Vamorr 48	187.5	187.7	186.7	561.9	187.30
CA 415, Vamorr 50	183.2	181.7	182.8	547.7	182.57
CA 416, Turkish tobacco ..	166.4	166.7	167.5	500.6	166.53
CA 417, do ..	163.8	162.2	160.6	486.6	162.20
CA 419, do ..	181.2	181.1	178.8	541.1	180.37
Total	1261.3	1258.3	1256.0	3775.6	

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties	6	2,218.97	369.83	406.41	3.00	4.82
Replications ..	2	2.02	1.01			
Error	12	10.89	0.91			
Total	20	2,231.88				

L.S.M.D. = 1.68.

TABLE 11

Comparative yields of sun-cured leaf and calculated yields to a hectare

VARIETIES	YIELD OF SUN-CURED LEAF OF REPLICATIONS			TOTAL	MEAN	CALCULATED YIELD PER HECTARE
	1	2	3			
	grams	*grams*	*grams*	*grams*	*grams*	*kg.*
CA 412, Dixie Bright 101	4081.5	3195.1	3552.4	10,829.0	3609.66	1432.4
CA 413, Dixie Bright 102	2698.3	2873.7	2560.8	8132.8	2710.93	1075.8
CA 414, Vamorr 48	2301.1	2681.6	2600.2	7582.9	2527.63	1003.0
CA 415, Vamorr 50	2516.3	2756.2	2318.2	7590.7	2530.23	1004.1
CA 416, Turkish tobacco	849.3	969.8	926.8	2745.9	915.30	363.2
CA 417, do	866.3	761.2	831.5	2459.0	819.66	325.0
VA 419, do	913.6	923.3	1036.5	2873.4	957.80	380.1
Total	14,226.4	14,160.9	13,826.4	42,213.7		

Analysis of variance

SOURCES OF VARIATION	DF	SUM OF SQUARES	MEAN SQUARE	COMPUTED F-VALUE	TABULAR F	
					0.05	0.01
Varieties	6	21,933,642.39	3,655,607.06	69.30	3.00	4.82
Replications ..	2	13,151.45	6,575.72			
Error	12	632,844.18	52,737.01			
Total	20	22,579,638.02				

L.S.M.D. = 408.56.

TABLE 12

Quality of sun-cured leaf

VARIETIES	COLOR	TEXTURE	AROMA	BURNING QUALITY
CA 412, Dixie Bright 101 ..	Light brown to light yellow	Good	Mild	Good
CA 413, Dixie Bright 102 ..	Light brown to dull yellow	Good	Mild	Good
CA 414, Vamorr 48	Dark brown to light brown	Coarse	Medium to mild	Medium to slow
CA 415, Vamorr 50	Dark brown to light brown	Coarse	Medium to mild	Medium to slow
CA 416, Turkish tobacco ..	Light brown to light yellow	Fine	Mild	Good
CA 417, do ..	Light brown to light yellow	Fine	Mild	Very good
CA 419, do ..	Light brown to light yellow	Fine	Mild	Very good

THE PROPORTION OF COPRA MEAL AND FISH MEAL IN RATIONS FOR GROWING AND FATTENING PIGS [1]

BIENVENIDO V. GARCIA

The results obtained from this investigation showed that the differences in relative efficiency among the different swine rations with varying proportions of copra meal and fish meal by weight were insignificant. Thus, the proportion of copra meal and fish meal required for growing and fattening hogs is probably elastic, and a variation thereof within the limits used in the present study would yield similar results. The inconclusive results, however, may have been due to the small number of pigs used in the experiment, which precluded the satisfactory elimination of errors arising from individual variation of the animals.

The College standard swine rations for growing and fattening pigs, which were formulated from various feeding experiments conducted in the Department of Animal Husbandry from 1916 to 1930,[2] have been used as basis for comparison in hog-feeding trials. In an attempt to improve these rations further, the changes which can be made in the proportion of copra meal and fish meal, the two feeds that make up the protein supplements, were determined.

According to Smith,[3] Crowther found that pigs fed with fish meal consumed more feed and made faster and more economical gains than those on vegetable protein feed. Gallardo (1929)[4] reported that when copra meal constituted 30 per cent of rations of six- to nine-month-old pigs fed in pasture, the best gain in weight was made. Pigs fed in dry lot with 30 per cent copra meal required less feed to make one kilogram gain than those fed with 40 per cent copra meal.

This work to determine the best proportion of copra meal and fish meal for growing and fattening pigs, as shown by rate of growth, feed consumption, and feed cost for each unit of gain, was conducted from August 14, 1949, to April 12, 1950, in the Department of Animal Husbandry, College of Agriculture.

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[1] Central Experiment Station Contribution No. 1661. Thesis presented for graduation with the degree of Bachelor of Science in Agriculture from the College of Agriculture, April, 1951. Prepared in the Department of Animal Husbandry under the direction of Dr. Mariano Mondoñedo.

[2] A handbook of Philippine agriculture. 1939. College, Laguna: U. P. College of Agriculture.

[3] SMITH, W. W. 1937. Pork production. Rev. ed., xxii + 575 p. New York: The MacMillan Company.

[4] GALLARDO, C. R. 1929. A study on the effect of varying amounts of copra meal on the growth of shotes. Philippine Agriculturist **19**: 113–116.

MATERIALS AND METHODS

Twenty female weanling grade pigs of uniform age, weight, and apparent health were divided into four equal lots. Lot II, fed with the College standard rations, served as control. The amounts of ground corn and fine rice bran were the same for all the lots. The distribution of copra meal and fish meal followed an inverse proportion, that is, the amount of copra meal was increased as the amount of fish meal was decreased.

The constituents of the rations of the four lots for the four feeding periods, all parts by weight, were as follows:

FEED CONSTITUENTS	LOT I	LOT II	LOT III	LOT IV
60-day feeding period (growth period); pigs, 2 to 4 months old				
Ground corn	10	10	10	10
Fine rice bran	60	60	60	60
Copra meal	20	22	24	26
Fish meal	10	8	6	4
Total	100	100	100	100
Nutritive Ratio	1:4.5	1:4.9	1:5.3	1:5.8
120-day feeding period (growth and fattening period); pigs, 6 months old				
Ground corn	15	15	15	15
Fine rice bran	60	60	60	60
Copra meal	17	19	21	23
Fish meal	8	6	4	2
Total	100	100	100	100
Nutritive Ratio	1:5.1	1:5.5	1:6.0	1:6.6
180-day feeding period (fattening period); pigs, 8 months old				
Ground corn	20	20	20	20
Fine rice bran	60	60	60	60
Copra meal	14	16	18	20
Fish meal	6	4	2	0
Total	100	100	100	100
Nutritive Ratio	1:5.7	1:6.3	1:6.9	1:7.6
240-day feeding period (fattening period); pigs, 10 months old				
Ground corn	25	25	25	25
Fine rice bran	60	60	60	60
Copra meal	12	13	14	15
Fish meal	3	2	1	0
Total	100	100	100	100
Nutritive Ratio	1:6.9	1:7.2	1:7.6	1:8.0

The weekly weight and feed consumption of each animal were recorded. The initial weight of every pig was the average of the weights taken two days before the experiment and on the first day of the experiment; the final weight was the average of the weights of the last three days.

All the lots were subjected to the same method of feeding and management. A sufficient amount of each ration was prepared to last the pigs for one week. The pigs were given all the feed they

could readily consume twice daily, in the morning and in the afternoon. The feed was in the form of fairly thick slops, about 1 part feed to 2 parts water. Fresh water was provided at all times and fresh camote vines were given three times a week.

Each lot was confined in a pen. The pigs were fed separately by lots within the pens, and a yard, 25 meters x 75 meters, was provided for them to range in between meals. The range was divided into two and used alternately for sanitation. The inclosure was bare of vegetation. A few trees along the fence provided sufficient shade for the pigs during hot weather. In inclement weather, the pigs were kept inside the hog pens.

RESULTS AND DISCUSSION

Rate of gain, amount of feed in kilograms needed to make a kilogram gain in weight, and cost of feed to make a kilogram gain were the bases for judging the relative efficiency of the different rations used.

The 60-day feeding period. Based on the three criteria, lot I gave the best results; lot II ranked second; lot III, third; and lot IV, last. Lot I made an average daily gain of 0.36 kg., which was 29 per cent better than the 0.28 kg. gain made by lots II and III. Lot IV made an average daily gain of only 0.24 kg. The amount of feed required by the pigs in lot I to produce a kilogram gain in weight was 3.06 kg. Lot II needed 3.72 kg., and lot III, 3.86 kg. The pigs in lot IV consumed the largest amount, 4.08 kg. With respect to the cost of the feed needed to produce the same unit of gain, lot I, the most economical, cost 43.76 centavos; lot II, the second, 51.71 centavos; lot III, the third, 52.11 centavos; and lot IV, the least economical, 53.86 centavos.

On the assumption that the three criteria used to measure the efficiency of the four rations were equal in importance and that the average general efficiency of lot II ration, the standard ration, was 100 per cent, the ration of lot I was 123 per cent efficient; that of lot III, 99 per cent; and that of lot IV, 91 per cent.

One pig in lot I died on the seventh week of the experiment. Post-mortem examination showed that the probable cause was swine plague.

The 120-day feeding period. A comparison of the average daily gains in weight of the pigs during this period showed that lot I gained 0.35 kg.; lot II, 0.34 kg.; lot III, 0.30 kg.; and lot IV, only 0.27 kg. To make a kilogram gain, lot II consumed the least feed, 4.04 kg. Lot IV utilized 4.41 kg. of feed, and lot I, 4.47 kg. Lot III consumed the most feed, 4.56 kg. The lot II ration cost the least to make a kilogram gain in weight after 120 days of feeding, 56.16 centavos. The lot IV ration, with a feed cost of 58.21 centavos, ranked second; lot III, with 62.02 centavos, third; lot I, with 63.92 centavos, fourth.

In general efficiency, based on the three criteria, lot I was 93 per cent as efficient as the control lot; lot IV, 89.17 per cent; and lot III, 89.13 per cent.

The 180-day feeding period. Lot 1, with an average daily gain of 0.33 kg., which was 6 per cent better than the 0.31 kg. gain made by lot II, continued to show the best results in rapidity of gain. Lot III, with an average daily gain of 0.30 kg., ranked third, and lot IV, with an average daily gain of 0.23 kg., fourth. In the amount of feed consumed for every kilogram gain in weight, lot II, with an average of 4.85 kg., required the least; lot III, with 5.01 kg., ranked second; lot I, with 5.16 kg., third; and lot IV, with 5.62 kg., fourth. With respect to the cost of feed to produce the same unit of gain, the lot II ration, with a feed cost of 67.42 centavos, was the most economical; lot III, with 68.12 centavos, second; lot I, with 73.79 centavos, third; and lot IV, with 74.18 centavos, the least economical.

From the standpoint of general efficiency, it appeared that the ration of lot II during the 180-day feeding period was the best feed for the pigs. The ration of lot III ranked second; that of lot I, third; and that of lot IV, fourth.

The 240-day feeding period. The results obtained during the period of eight months of feeding showed that the pigs in lot I made an average daily gain of 0.34 kg., which was 13 per cent as efficient as the 0.30 kg. made by the pigs in lot II, the control lot. The pigs in lot III gained 0.29 kg., and the lot IV pigs, 0.23 kg. In the conversion of feed to make a kilogram gain in weight, lots I and III utilized 5.80 kg. of feed, which was 100.17 per cent as efficient as the 5.81 kg. (100 per cent) required by lot II. Lot IV utilized the most feed, 6.54 kg., which was 11.23 per cent less efficient than the rations of lots I and III. In the economy of feed needed to produce the same unit of gain in weight, lot III ranked first, with a feed cost of 78.88 centavos, which was 3 per cent more economical than the 81.34 centavos of lot II. Lot I was third, with a feed cost of 82.94 centavos, which was 5 per cent less efficient than lot III. Lot IV, with a feed cost of 86.98 centavos, which was 9 per cent less efficient than lot III, was the most expensive.

According to the general efficiency of the rations, lot I was 104 per cent efficient; lots II and III, 100 per cent; and lot IV, 86 per cent.

One pig in lot II died on the twenty-eighth week of the experiment. Post-mortem examination pointed to heatstroke as the cause of death.

MARKETING CATTLE IN THE PROVINCE OF MASBATE [1]

N. B. TABLANTE

WITH THREE TEXT FIGURES

A small ranch in Masbate has an average size of about 84 hectares and has a herd of 35 cattle, 3 carabaos, and 2 horses; a large ranch is about 800 hectares and has 465 cattle, 28 carabaos, and 7 horses. A large part of the pasture lands is leased from the Bureau of Forestry at 60 centavos a hectare a year.

The types of market outlets for Masbate cattle vary according to the needs of the owners for cash, means of transportation, number of animals for sale, distance from markets, and attention that can be given to marketing. Cattle raisers use either the direct or the indirect method of marketing or both. The most common markets are the local butchers and buyers and the neighboring farmers. Cattle raisers also sell to traders, to other cattle farmers, and to the stockyard in Manila.

Prices vary according to the size and general finish of the animal in relation to the estimated dressed weight. Yearlings for slaughter are sold for about ₱80 each; old females, ₱90; young males, ₱100; young females, ₱150; and castrated cattle, ₱200. Red Sindhi stock for breeding purposes, regardless of sex, sell for ₱200 each when 7 to 12 months old and for ₱250 to ₱300 when over one year old.

Total costs of shipping a head of cattle from Masbate to Manila amount to ₱36, which is about 14 per cent of the average price of ₱260 that it will bring in the stockyard in Manila. The costs include the fees for registration and the certificate of transfer of title; the expense of bringing the animal from the ranch to a convenient loading place, loading on a truck or barge, transporting to port of shipping, loading on the ship, shipping, and handling in the stockyard in Manila; and miscellaneous items.

Cattle raising is one of the most important industries in the province of Masbate. In 1940, Masbate had a cattle population of 75,640 head and ranked third among the cattle-raising provinces of the Philippines, according to figures obtained from the Bureau of Census and Statistics. The war, however, destroyed many of the ranches [2] so that as of January 1, 1951, Masbate had only 17,830 head out of a total of 715,150 for the Philippines.

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[1] General Contribution No. 854. Most of the data in this report were gathered personally by the writer from observation and from interviews of livestock owners during a survey-project visit of Masbate from April 21 to May 11, 1952, financed by PHILCUSA–ECA. The writer acknowledges all assistance and cooperation which made this report possible. Special thanks are due the governor of the province, the provincial veterinarian, Atty. Emilio Espinosa, Jr., Mr. Clemente Bajar, Mr. John Miller, and Mrs. Rafael Resurreccion.

[2] VILLEGAS, VALENTE. 1948. Our post-war livestock industry. Agricultural–Commercial–Industrial Life 10 (11): 2–3, 33.

Villegas [3] reported that the leading livestock municipalities in Masbate were Milagros, San Pascual in Burias Island, San Fernando in Ticao Island, Cataingan, Aroroy, Dimasalang, and Masbate. According to the Office of the Provincial Veterinarian in Masbate, 2,149 carabaos, 1,726 cattle, 1,678 horses, 6,832 pigs, 15,942 chickens, 75 goats, 37 turkeys, and 19 ducks were shipped to Manila and to other provinces from 1945 to 1951, and 1,509 cattle, 406 carabaos, and 12,752 pigs were slaughtered from the time the province was liberated to December, 1951.

Since 1925 (Manuel, 1925), Masbate has been one of the sources of cattle slaughtered in Manila. Manuel stated that the large-type Masbate cattle had an average dressed weight of about 155 kilograms and returned, on the average, ₱130 a head; the small type averaged about 79 kilograms and gave a return of ₱56.

Manresa observed in 1930 that the majority of the beef steers raised in Bukidnon were shipped to Manila, and the majority of the work steers, to the sugar plantations of Negros. Because the ranchers there did not have an organized system of marketing cattle, they found it difficult to sell small numbers of animals.

Villegas [4] suggested the sale of livestock by live weight, which he believed to be a just and rapid way of disposing of market animals. The cattle and carabaos are made to step on a portable platform scale, first with the front legs and then the hind legs. The sum of the two weights represents the weight of the animal.

The present study was made in Masbate in the summer of 1952 in order to understand the methods, types of markets, prices, services, and costs involved in marketing the cattle raised in that province. Ranch owners, ranch foremen, laborers, buyers, butchers, transportation firms, and government agencies cooperated in supplying the pertinent data and other information.

DISCUSSION OF FINDINGS

Size of ranch. Under normal conditions, at least one hectare of pasture land is allotted to each head of cattle. In Masbate, the majority of the ranches surveyed have extensive pastures which are sometimes three or four times greater than this average requirement. The pasture areas are large to provide for the possibility of increasing the herd, to allow better rotation of pastures for more economical feeding arrangements, and to prevent overgrazing.

Most of the pasture lands are leased from the Bureau of Forestry at an annual rental of ₱0.60 a hectare. In the small ranches where the number of animals ranges from 20 cattle, 1 carabao, and

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[3] *Ibid.*

[4] VILEGAS, VALENTE. 1949. Marketing livestock by live weight. Agricultural–Commercial–Industrial Life **11** (7): 17, 20.

2 horses to 50 cattle, 6 carabaos, and 4 horses, of different sexes and ages, the pastures are from 25 to 185 hectares; the average is 84 hectares. In the large stock farms, the herd ranges from 150 cattle, 3 horses, and 5 carabaos to more than 1500 cattle, 20 horses, and 100 carabaos, also of all ages and sexes. The area of the pastures ranges from 200 to 2,000 hectares, or an average of about 800 hectares to a ranch. The pasture area of 5,000 hectares of the government stock farm was not counted as its size is very large in proportion to the number of about 250 animals kept on it. If the government stock farm were included, the average area would be 1,154 hectares. The average pasture area is much more extensive than the requirement of one hectare to a head (fig. 1).

Fig. 1.—A typical pasture in Masbate.

Breeds of animals. Most of the cattle in Masbate are grade Nellore; a few native and grade Red Sindhi are also found in some ranches. The stock sold by the government stock farm in Manangue, Milagros, for breeding purposes are purebred Red Sindhi.

Old males are commonly sold for slaughter purposes. Females that are already past their usefulness or are physically defective also find their way to the slaughterhouses. They do not weigh as much as the castrated males and are therefore sold at comparatively lower prices. According to butchers and beef consumers, the young females give the best meat, but they are seldom sold for slaughtering since they can be used to advantage in increasing the herd.

Types of markets commonly used. Masbate cattle-raisers have many outlets for marketing their livestock. Their choice of market

varies according to the need for cash, transportation facilities, number of animals for sale, location, and attention that can be given to marketing. When the need for small amounts of cash is urgent, the owner sells to local buyers, who are either butchers or shippers residing in the vicinity of the ranch. If the owner's need for cash is not immediate and if he can attend to the details of shipping and his ranch is within easy access of transportation facilities, he ships his animals direct to Manila or to neighboring provinces, like Sorsogon and Albay. If the ranch is at a distance from roads or ports, middlemen are necessary in marketing cattle. The marketing services and costs, however, are practically uniform under all these conditions.

Cattle farmers in Masbate sell their animals in small numbers of 3 to 20 head a consignment two to four times a year. Sales become more frequent with smaller consignments and in the large ranches. The frequency of marketing depends upon the need for cash, fear of overgrazing the pasture, desire to dispose of poor animals, and demand of buyers for stock.

The local market includes slaughterers and buyers who purchase stock for resale to other markets or for their own use. This outlet generally absorbs small consignments. For slaughtering, the demand is for tame females, 3 to 5 years old, because the good quality of their meat commands a higher price on the market.

Cattle farmers from the same municipality or from other places are another market outlet. In this outlet one farmer sells the replacement livestock or other livestock to another farmer for further feeding or for breeding. Young breeding stock are handled through this market in consignments of one to three head at a time.

Traders are the most important and the most common market for Masbate cattle. These buyers go to the ranches, select the animals, pay in cash for all the stock they purchase, and deliver the livestock to other markets or users. In Bukidnon, buyers go to the ranches at regular intervals to buy beef steers, paying from ₱80 to ₱95 a head (Manresa, 1930). In Masbate, one class of buyers supplies the meat of a shipping company. The usual destination of the shipments is the stockyard in Manila, where the animals are slaughtered and sold as meat to the public markets, hotels, restaurants, and shipping companies. Sometimes, when the animals are for purposes other than slaughter, the buyers only act as brokers. The cattle sold are of varying ages and sexes and are usually in larger consignments.

The type of market, therefore, varies among farmers in the same area. The main consideration in comparing the different methods of marketing is the cost-price relationship. In the United States, area differences in available markets exist. Curtiss [5] and

[5] CURTISS, W. M. 1945. Marketing New York meat animals. Cornell University Agric. Exper. Sta. A. E. No. 542: 5–6 (Mimeographed).

Wills (1951) reported that the most common types of market outlets used by farmers in New York and in Illinois were terminal public markets, livestock consignment auctions, local livestock dealers and butchers, traders, and other farmers, but the available outlet varied in importance in these two states.

Prices. Livestock are bought and sold by the head; the prices depend on the size, age, and general physical condition of the animal, relative to its dressed weight. Table 1 shows the prevailing prices of the different classes of livestock sold in Masbate. Castrated cattle command the highest price among the slaughter group, possibly because they are estimated to have a dressed weight of 200 kilos or more. In the stockyard in Manila these animals are sold at a wholesale price of ₱1.80 to ₱2.00 a kilogram dressed weight. Yearlings have an estimated dressed weight of 70 to 80 kilos. In Manila, females of two to five years, with a dressed weight of 100 to 120 kilos, sell at ₱2.00 to ₱2.40 a kilo, wholesale; those of six years or more, with a dressed weight of 90 to 100 kilos, sell at ₱1.90 to ₱2.00 a kilo. The wholesale cuts of beef supplied to the General Shipping Company in Masbate are delivered at ₱1.60 a kilo. Villegas and Flores (1950) stated that cattle sold by dressed weight in Baguio cost from ₱1.90 to ₱2.10 a kilogram.

The prices of breeding stock were obtained from the stock farm of the Bureau of Animal Industry at Manangue, Milagros, Masbate. The prices are rather standardized, in accordance with instructions from the head office of the BAI in Manila. Regardless of sex, Red Sindhi cattle for breeding, of one year or less, sell for ₱200.00 each, and those over one year but not exceeding two years, for ₱250.00 to ₱300.00.

Marketing services and costs. Table 2 shows the various items of costs in shipping a head of cattle from Masbate to Manila. The services involved have to do chiefly with transportation and assembling activities incidental to the buying and selling operations. In this study, the marketing costs include only those expenses actually incurred in shipping the animals from the ranch to the stockyard in Manila. Shrinkage in transit, a factor in selling livestock, was not determined because the animals were not weighed before shipment.

Whether the owner ships his animals direct to Manila or indirectly through a buyer, a registration fee of ₱1.00 and a certificate of transfer of title fee of ₱5.00 are paid for each head of cattle by the owner or the buyer, depending upon previous arrangement between the two parties. These fees account for about 17 per cent of the total shipping costs. Manuel (1925) reported that when the animals were not registered in the province before shipment to Manila, a combined fee of ₱3.00 a head was charged for registration and transfer.

Bringing the animals from the ranch to a convenient shipping point, such as the roadside or the "toril" (catching and loading corral) (fig. 2) on the shore, costs from ₱1.00 to ₱8.00 a head, or an

Fig. 2.—Catching and loading corral ("toril").

Fig. 3.—Hauling a stubborn steer on a sled from the ranch to the roadside.

average of ₱3.00, according to the distance of the ranch from the loading point. This service, which includes catching the stock and driving or hauling them to the place where they are to be loaded, represents 8 per cent of the total costs. When the animals cannot be

driven easily, they are thrown down, tied, and hauled on a sled by a carabao (fig. 3).

The cost of loading on the truck or barge is ₱1.00 a head. Two or three medium-sized cattle can be loaded in the baggage compartment of a passenger truck, and from five to eight head, on a regular freight truck. As many as 40 head can be safely loaded on barges. The cost of transporting to the port of Masbate ranges from ₱2.00 a head for a 16-kilometer distance to ₱8.00 for a 77-kilometer distance and averages about ₱5.50. This is equal to 15 per cent of all costs.

When the animals reach the port, ₱1.00 a head is paid for loading them on the ship that will take them to Manila. Usually, a belt-like device is placed around the breast of the animal to prevent injury. In some cases, a rope is tied around the base of the horns and the hook for leading the cattle into the hold is attached to it.

The freight charges from Masbate to Manila represent the largest single item of cost, ₱16 a head, or about 44 per cent of the total costs. According to the regulations in the Inspectors's Guide Book of the Bureau of Customs, livestock is shipped as double Class C freight, based on the established measurement of 1.000 cubic meter a head for cattle, horses, or carabaos. The food of the animals during the voyage is supplied by the shipper, and the water, by the carrying vessel. If the livestock is not delivered within two hours after arrival at the destination, it is held solely at the owner's risk.

In Manila, handling expenses in the stockyard, including unloading and yardage, average ₱2.00 a head. According to regulations, the charge for subsistence and care for each succeeding 24 hours or fraction thereof for horses, cattle, and carabaos is ₱1.00 each. When the animals are unloaded at the pier, they are driven directly to the stockyard. Miscellaneous items, such as ropes, tips, etc., cost an average of ₱1.50 for each head of cattle marketed.

The total costs, therefore, of moving cattle from Masbate to the Manila market amount to ₱36 a head. Since costs of livestock marketing are generally based on each head of cattle, there is an inverse relationship between total costs and the average sales value of the animal at the stockyard, that is, higher-priced animals have lower marketing costs for each peso of sales value than the lower-priced ones. Furthermore, since a higher selling price depends mainly on better quality and a heavier estimated dressed weight, better returns resulting from decreased relative costs of marketing are possible. On this basis, and with ₱1.90 as the average wholesale price for each kilo of dressed weight in Manila, the marketing costs for every peso of average sales value of cattle estimated to have a dressed weight of at least 200 kilos would be almost half as much as those of animals weighing less than 100 kilos. The shippers, therefore, can have less expense for every peso of gross returns by shipping higher quality livestock that will command a higher price for each unit weight.

CONCLUSIONS

1. Masbate ranchers generally ship their cattle in small consignments more than once a year. Hence, shipping directly does not pay because small consignments increase the costs of marketing in relation to the gross returns from sales. The buyers, or traders, sell the livestock in the same market where the farmer sells so that they have the same marketing expenses, with only a small margin to keep them in business. Besides, the rancher usually lacks a thorough knowledge of prevailing market conditions or considers marketing beneath his efforts, granting that he has the time to attend to it.

2. Since cattle raisers are often forced to sell a few head of animals at a time, primarily because of their need for cash, their bargaining position is weakened and they cannot take advantage of better prices for their livestock. Rural credit agencies from which ranchers can obtain providential or productive loans, with their livestock as security, must be established. Long-term loans with easy repayment plans are also needed to enable the ranchers to rehabilitate their farms which were destroyed during the war.

3. The cattle from Masbate are thin and of poor finish, so that their estimated dressed weights are low. Since prices are largely based on the quality of the cattle and since most of the marketing costs are by the head, livestock of higher quality that will give the maximum net market returns must be raised. This means improving the breed, as well as the management, of the animals. Republic Act No. 699 (House Bill No. 1923), which provides for a special fund known as the "Philippine Livestock Promotion Fund" for the introduction, propagation, and distribution of purebred and improved breeding animals and for the establishment of public breeding stations, will go a long way towards improving the quality of the animals marketed.

4. The government should establish definite standards of classification for livestock intended for the market. A good system of classing and grading, based on points or characteristics recognized by sellers, buyers, and butchers, is essential for more understandable market quotations. Animals can be marketed by description rather than by inspection, so that the expenses of buying and selling are lessened. Also, a good system of market classification will make possible the standardization of prices of market animals.

5. Transportation is the biggest single item of marketing. Transportation facilities in the province of Masbate are very poor so that efficient marketing of farm products is handicapped. Cattle are handled roughly in the process of transporting from the farm to the stockyard, and excessive in-transit shrinkage results. Truckers and shipping companies should, as much as possible, avoid over-

crowding of the animals being transported. A livestock shipping association which would enable small producers to ship their animals together, giving to each the advantages of the large-scale shipper, might be formed. In this way, cattle farmers can have increased returns through better trade contacts of the association, reduced losses in transit, and more efficient marketing services at reduced marketing expenses. Finally, the individual producers are brought in closer touch with the market and its requirements.

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TABLE 1

Prices paid for livestock in Masbate in 1952

ITEM	LOW	MEDIUM	HIGH
	pesos	*pesos*	*pesos*
Cattle:			
Slaughter: (Grade Nellore or native)			
Yearling	50.00	80.00	100.00
Castrated, or old male	150.00	200.00	250.00
Male, young	90.00	100.00	120.00
Female, young	100.00	150.00	200.00
Female, old	80.00	90.00	100.00
Breeding: (Red Sindhi)			
One year or less	—	200.00	—
Over one year	—	250.00	—
Carabaos:			
Slaughter:			
Male	80.00	100.00	120.00
Female	100.00	125.00	140.00
Draft	180.00	190.00	200.00
Horses:			
Below 2 years	25.00	40.00	55.00
Two years or more	40.00	60.00	75.00

TABLE 2

Cost of shipping a head of cattle from Masbate to Manila

ITEM	AMOUNT	PERCENTAGE OF TOTAL COSTS
	pesos	*per cent*
Registration fee	1.00	2.8
Transfer of ownership	5.00	14.0
Catching and fetching from ranch	3.00	8.3
Loading on truck or barge	1.00	2.8
Transporting to shipping point	5.50	15.2
Loading on ship	1.00	2.8
Freight	16.00	44.4
Handling in the Manila stockyard	2.00	5.5
Miscellaneous	1.50	4.2
TOTAL	36.00	100.0

COLLEGE AND ALUMNI NOTES

Dr. Otto A. Reinking, the guest speaker at a scientific meeting of the Los Baños Biological Club on February 29, 1952, discussed abacá mosaic and its control. Slides prepared by Dr. Reinking were shown on the screen.

The freshmen burned their skullcaps in a bonfire at a rally held on March 1, 1952. The rally was preceded by a torch parade on the campus. Archimedes Laurel is the president and Dr. S. M. Cendaña, the adviser of the freshman class.

Miss Edelwina C. Cu, Bachelor of Arts, *magna cum laude,* from the University of the Philippines, was appointed instructor in English on March 1, 1952.

At a meeting of the Society for the Advancement of Research held on March 3, 1952, the following were elected: to active membership—Dr. Pedro A. David and Mr. Pedro A. Rodrigo: by affiliation—Dr. Gonzalo F. Merino, Mr. Faustino Q. Otanes, Dr. Jose Vera Santos, and Dr. Gregorio T. Velasquez: to associate membership —Mr. Pedro B. Escuro and Mr. Jose O. Juliano.

The newly elected officers of the society are Dr. Valeriano C. Calma, president, and Dr. Eulalio P. Baltazar, vice-president.

Miss Nieves Buhay, a graduate of the U. P. with the degree of Bachelor of Science in Pharmacy in April, 1952, was appointed research assistant in the Department of Soils on February 8, 1952.

The following were recently elected officers of the new board of directors of the College Cooperative Company, Inc.,: Dr. G. B. Viado, president; Prof. M. A. Gapud, secretary; and Miss N. Dunglao, treasurer. The other members of the board are Dr. J. R. Velasco, Mr. A. C. Campos, and Mr. W. L. Fernandez, who is concurrently manager of the College Cooperative.

Dean L. B. Uichanco, '15, was unanimously reelected president of the Laguna Council, Boy Scouts of the Philippines, in a recent meeting of the Council at the Calauan Elementary School.

Mr. Cenon R. Flor Cruz, '35, director of the industrial division of PHILCUSA, returned after a four-month stay in the United States where, as U. N. fellow, he observed American industrial development.

Mr. Quintin Eala, '27, is at present attending seminar courses in librarianship in Australia as a fellow of the Australian Government under the Colombo Plan for Southeast Asia. Mr. Eala is the chief of the library division of the Institute of Science and Technology.

Mr. Alfonso N. Eusebio, '44, visited the College and inquired into the possibility of securing dairy cattle. He is with the teach-

ing staff of the Central Luzon Agricultural College in Muñoz, Nueva Ecija.

Several alumni participated in the afternoon session of the third national nutrition conference held on March 6, 1952, at the Institute of Hygiene Auditorium, at which Dr. F. O. Santos, '19, presided. Dr. Deogracias V. Villadolid, '19, read a paper on international fishing and fisheries; Dr. Francisco M. Sacay, '25, discussed food production and population increases; and Mr. Francisco D. Marquez, '15, talked on food distribution problems. The following participated in various sessions: Dr. Manuel L. Roxas, '11, Mr. Gonzalo H. Salazar, '25, Mr. Francisco V. Gomez, '35, Dr. Lorenzo P. Zialcita, Jr., '38, Mr. Celso G. Santos, '46, and Mr. Guillermo P. Santos, '48.

The following were awarded degrees of Bachelor of Science in Agriculture at the University commencement exercises on April 8, 1952: Leonardo A. Abarra, Cipriano B. Abulencia, Sotero I. Albano, Jr., Cipriano G. Ancheta, Quirino A. Anoos, Rufino D. Ayaso, Jr., Aproniano P. Azares, Donato C. Azman, Jacinto F. Babaan, Francisco C. Bandong, Marcelo M. Bartolome, Casimero D. Bascos, Roland N. Caasi, Simeon L. Cadiz, Teodoro G. Cadiz, Daniel P. Caguioa, Sotero A. Calaustro, Patrocinio G. Dayrit, Manuel M. Defiño, Pedro B. Escuro, Roman R. Estioko, Jr., Emigdio L. Fabella, Vito F. del Fierro, Jr., Casimiro V. Guieb, Jose Juban, Jose O. Juliano, Alfonso M. Lagman, Mauro L. Ruma, Andres T. Lucas, Roman L. Lucas, Deogracias V. Maligalig, Tobias B. Manzano, Narciso M. Natividad, Adelino V. Ordeño, Rogerio A. Pablo, Emilio U. Quintana, Felino B. Rivera, Aurelio S. Rodriguez, Obedencio S. Salvia, Jaime A. Sandique, Severino R. Santos, Jr., Dominador M. Tombo, Jr., Rodolfo V. Torreda, Jesus Torreta, Carlos G. Valdez, and Juan O. Villena.

Pedro B. Escuro and Jose O. Juliano graduated *magna cum laude*. They were awarded Joaquin J. Gonzalez medals.

The following were awarded certificates in Agricultural Education: Francisco C. Bandong, Marcelo M. Bartolome, Vito F. del Fierro, Jr., and Severino R. Santos, Jr.

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